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A HANDBOOK
OF THE
DESTRUCTIVE INSECTS
OF
VICTORIA

WITH NOTES ON THE METHODS OF PREVENTION
AND EXTIRPATION.

Prepared by Order of the Victorian Department of Agriculture

BY

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Government Entomologist.

PART IV.

Melbourne:

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PREFACE TO PART IV.

IN publishing the Fourth Part of "The Handbook of the Destructive Insects of Victoria," it will be noticed that insects attacking our forests have a more prominent place than has hitherto been allotted them. This because of the ever-increasing importance of our trying to save, by all means possible, the rapid and total destruction of the valuable timber forests of this State.

The increasing interest taken in economic entomology and ornithology, and the proposal to add to the valuable nature-study teaching in our State Schools, renders it imperative that as much practical information as possible be forthcoming and made easily available.

The growing demand for Part I. of this book has induced the Agricultural Department to issue a second edition, the former edition of 8000 copies having been long since exhausted, the demand for all the parts being of a most satisfactory nature.

A number of plates for Parts V. and VI. are ready, and these will be added to as opportunity offers. My artist-naturalist, MR. C. C. BRITTLEBANK, is still contributing, by means of his beautiful drawings, towards the success of this book.

Ornithology, too, has a prominent place in the present volume; the economic study of birds, both injurious and useful, being of the greatest value to those engaged in rural pursuits. These bird plates will be added to in Part V.

A copy of the "Amended Vegetation Diseases Act" will be found useful by many growers, shippers and others; while the list of insects proclaimed under the "Vegetation Diseases Act" will be of interest and use to many—growers and otherwise.

Where personal opportunities for observation have been impossible, quotations from the writings of well-known and up-to-date entomologists have been largely availed of; and without such information the present book would have been minus much of its value.

There is comparatively little new to chronicle in the way of spraying implements; and these, together with up-to-date spraying materials, have a place to themselves towards the end of the present volume.

C. FRENCH.

MELBOURNE, 1908.

VICTORIA.



ANNO SEXAGESIMO TERTIO

VICTORIÆ REGINÆ.

No. 1644.

An Act to continue the *Vegetation Diseases Act 1896*

[19th February, 1900]

BE it enacted by the Queen's Most Excellent Majesty by and with the advice and consent of the Legislative Council and the Legislative Assembly of Victoria in this present Parliament assembled and by the authority of the same as follows (that is to say):—

1. The *Vegetation Diseases Act 1896* (except section eighteen which is hereby repealed) shall be and the same is hereby continued in full force and effect.

Continuance
of No. 1432.

VICTORIA.



ANNO PRIMO

EDWARDI SEPTIMI REGIS.

No. 1773.

An Act to amend the *Vegetation Diseases Act 1896*.

[23rd December, 1901.]

BE it enacted by the King's Most Excellent Majesty by and with the advice and consent of the Legislative Council and the Legislative Assembly of Victoria in this present Parliament assembled and by the authority of the same as follows (that is to say):—

Short title and
construction
No. 1432.

1. This Act may for all purposes be cited as the *Vegetation Diseases Act 1901*, and shall be construed as one with the *Vegetation Diseases Act 1896*.

Meaning of
"fungus"
and "insect"

2. For the purposes of this amending Act but not for the purposes of the principal Act "fungus" means any fungus or vegetable parasite whatever whether dead or alive which the Governor in Council may from time to time by proclamation in the *Government Gazette* declare to be a fungus within the meaning of this Act; and "insect" means any insect whatever which the Governor in Council may from time to time by proclamation in

the *Government Gazette* declare to be an insect within the meaning of this Act and includes any such insect whether dead or in any stage of living existence.

3. (1) No person shall sell or attempt to sell or expose for sale or cause to be sold or exposed for sale any diseased tree plant or vegetable.

Sale &c. of diseased trees plants or vegetables prohibited.

(2) If any person sells or attempts to sell or exposes for sale or allows or causes to be sold or exposed for sale any diseased tree plant or vegetable he shall for every such offence be liable on conviction to a penalty not exceeding Ten pounds.

Penalty.

4. At all times when any tree plant or vegetable is exposed for sale in any market or stall or shop or place or on any vehicle or stand every inspector shall have free access to such market stall shop or place or vehicle or stand and may examine all trees plants or vegetables exposed for sale in any such market stall shop or place or on any such vehicle or stand.

Examination by Inspector.

5. (1) If on any such examination the inspector is of opinion that any tree plant or vegetable inspected by him is diseased he may direct the owner or person for the time being in charge thereof to take all such measures or do all such acts as the inspector determines to be necessary for the eradication or destruction of such disease; but the inspector shall not except with the express consent of the owner or with the express authority of the Minister direct the destruction of any tree plant or vegetable.

Power of Inspector to give directions as to diseased trees plants or vegetables.

(2) If any person disobeys or fails to comply with any direction given pursuant to the provisions of this section such person shall for every such offence be liable on conviction to a penalty not exceeding Ten pounds.

Penalty.

Amendment of
s. 14 of No. 1432

6. In sub-section (1) of section fourteen of the *Vegetation Diseases Act 1896* before the word "direction" wherever occurring there shall be inserted the word "notice."

Proof of
signature of
Minister
unnecessary.

7. In any proceedings against any person for any offence against the *Vegetation Diseases Act 1896* it shall not be necessary to prove that any authority notice direction or order was actually signed by the Minister if it purports to be so signed.

VICTORIA.



ANNO SEXTO
EDWARDI SEPTIMI REGIS.

No. 2050.

An Act to further amend the *Vegetation Diseases Act 1896*.

[28th December, 1906.]

BE it enacted by the King's Most Excellent Majesty by and with the advice and consent of the Legislative Council and the Legislative Assembly of Victoria in this present Parliament assembled and by the authority of the same as follows (that is to say):—

1. This Act may be cited as the *Vegetation Diseases Act 1906*, and shall be read and construed as one with the *Vegetation Diseases Act 1896* and any Acts amending the same all of which Acts and this Act may be cited together as the *Vegetation Diseases Acts*.

Short title and construction.
Nos. 1432, 1644,
1773.

2. In the *Vegetation Diseases Acts* the word "case" wherever occurring shall be deemed and taken to include "covering."

Meanings of case, s. 4.

3. (1) Where by any of the provisions of the *Vegetation Diseases Acts* the Minister is empowered to make any order exercise any authority or give

Power of Minister to authorize Officer to act on his behalf.

any direction or consent he may by a special order under his hand authorize either generally or specifically any principal officer of the Department of Agriculture to make such order exercise such authority or give such direction or consent on his behalf. Every such special order shall be published in the *Government Gazette* and may be made only as regards such sections of the said Acts as are specified in such special order. Every such special order may be at any time revoked by the Minister.

Effect of
special order.

(2) During the continuance in office of the Minister making any such special order, any action taken or thing done or authority given for the purposes of the *Vegetation Diseases Acts* pursuant to such special order by the officer named therein shall have the like force and effect as if the same had been taken or done or given by the Minister.

Power for
Inspector when
authorized to
seize diseased
trees plants or
vegetables.

4. For the purpose of enabling the Minister to determine whether or not he will under section five of the *Vegetation Diseases Act 1896* make an order directing the destruction of any diseased tree plant or vegetable any inspector who is authorised in writing by the Minister either generally or specifically so to do may seize any diseased tree plant or vegetable whatsoever in Victoria whether the same was or was not introduced or brought into Victoria.

Power to confer
general
authorities on
Inspectors.

5. (1) Notwithstanding anything contained in the *Vegetation Diseases Acts* the Minister may in writing by a general order under his hand and published in the *Government Gazette* appoint any inspector to exercise with respect to any land whatsoever in any part of Victoria all or any of the powers exercisable by a person authorized by the Minister under section seven of the *Vegetation Diseases Act 1896* with respect to any particular land.

(2) Any inspector so appointed shall in respect Sections 7, 14. to all land in the part of Victoria for which he is so appointed have the like powers and authorities as a person authorized under the said section seven has in respect to the land in respect of which he may be authorised under the said section.

(3) Any appointment under this section may at any time be cancelled by the Minister.

6. A notice under section eight of the *Vegetation Diseases Act 1896* to the occupier or owner of any land may subject to the provisions of section ten thereof be served or given personally or through the post by registered letter addressed to such occupier or owner by name. Service of Notices.

7. Where under the *Vegetation Diseases Acts* any insect fungus tree plant or vegetable or any package or case containing or suspected to contain any such insect fungus tree plant or vegetable is authorised to be examined or seized or destroyed or treated or otherwise dealt with such insect fungus tree plant vegetable package or case or any part thereof may be if necessary and practicable removed to some place suitable for such examination or destruction or treatment. Power to remove to place suitable for examining.

8. (1) In addition to the purposes for which regulations may be made in accordance with the provisions of section thirteen of the *Vegetation Diseases Act 1896* regulations may also be made authorising and requiring inspectors to charge fees and expenses of such amounts or rates as the regulations may prescribe— Power to make regulations as to charging for services.

(a) for removing any insect fungus tree plant vegetable package or case imported No. 1432 S. 4 introduced or brought into Victoria to some place suitable for the examination thereof and also for examining the same; No. 1773 S. 4.
or

No. 1432 ss. 5, 9,
13.
No. 1773 s. 5.

(b) for taking any measures or doing any acts necessary for the treatment eradication or destruction of disease or the destruction or treatment of or otherwise dealing with any insect fungus tree plant vegetable package or case.

Collection of
charges.

(2) Such fees and expenses shall be chargeable to and recoverable from the owner or person in possession of any insect fungus tree plant vegetable package or case when removed or examined or destroyed or otherwise dealt with as the case may be and shall be payable into the Consolidated Revenue.

Amendment of
s. 13 of No. 1432.

9. (1) Sub-section two of section thirteen of the *Vegetation Diseases Act 1896* is hereby repealed.

Publication of
regulations.

(2) All regulations made by the Governor in Council pursuant to the provisions of the *Vegetation Diseases Acts* shall be published in the *Government Gazette* and when so published shall have the force of law and shall be judicially noticed and shall be laid before both Houses of Parliament within fourteen days after the same shall have been made if Parliament be then sitting and if not then within ten days after the next meeting of Parliament and a copy of any proposed regulations shall be posted to each Member of Parliament at least twenty-one days before such regulations are approved by the Governor in Council.

Amendment of
s. 14 of No. 1432.

10. In section fourteen of the *Vegetation Diseases Act 1896* before the word "authority" wherever occurring there shall be inserted the word "appointment."

VICTORIA.



ANNO SEXTO

EDWARDI SEPTIMI REGIS.

* * * * *

No. 2059.

An Act to Regulate the Sale or Export of Fruit in
Fruit Cases.

[28th December, 1906.]

BE it enacted by the King's Most Excellent Majesty by and with the advice and consent of the Legislative Council and the Legislative Assembly of Victoria in this present Parliament assembled and by the authority of the same as follows (that is to say):—

1. This Act may be cited as the *Fruit Cases Act 1906*, and shall come into operation on the first day of July One thousand nine hundred and seven.

Short title and commencement

2. In this Act unless inconsistent with the subject-matter or context—

Interpretation.

- (a) "Case" means any box case or receptacle used or capable of being used or intended to be used for containing fruit;

"Case."

"Fruit."

(b) "Fruit" means apples apricots bananas cherries currants figs gooseberries grapes loquats lemons nectarines oranges passion-fruit peaches pears persimmons pineapples plums quinces or tomatoes or any fruit declared by the Governor in Council by notice in the *Government Gazette* to be fruit within the meaning of the Act;

"Sale" "sell"
or "sold,"
Comp. No. 2010
S. 3.

(c) "Sale" "sell" or "sold" includes barter and also includes offers or attempts to sell or exposing or offers for sale or receiving for sale or sending forwarding or delivering for sale or causing or suffering or allowing to be sold offered or exposed for sale, but does not include exporting from Victoria.

Non-application 3. The restrictions contained in this Act shall not apply—

- (a) to the sale or export of fruit in a tray basket cask or bucket of any shape or size whatsoever; or
- (b) to the sale or export of fruit in a case for which letters patent were in force in Victoria immediately before the commencement of this Act; or
- (c) to the sale or export of fruit in a crate within which there are trays for such fruit; or
- (d) to the sale of fruit within two years after the passing of this Act in any package whatsoever on which or on a label card or tag attached thereto the net weight of the contents is truly and legibly printed stencilled impressed or marked in letters of not less than one inch in length.

Every package referred to in paragraphs (a) (b) and (c) of this section shall have the weights or numbers of its contents legibly marked on such package.

4. (1) Where any fruit is sold in a case such fruit shall be contained in a double-case single-case or half-case of a size and having (subject to an allowance for shrinkage as hereinafter provided) the measurements specified respectively in column two of the First Schedule to this Act, and any case shall for the purposes of this Act be deemed to have the capacity specified respectively in column three of the said Schedule.

Size of cases for sale of fruit.

First Schedule.

(2) Where fruit is sold in a case which has previously been used for any purpose whatsoever a shortage of five per centum from the cubical contents respectively set out in column three of the said Schedule shall be permitted as an allowance for shrinkage.

Shrinkage.

5. (1) Where any fruit is exported in a case from Victoria to any country or place such fruit shall be contained only in a single-case or half-case which has not previously been used for any purpose whatsoever.

New cases to be used for export

(2) No case shall be used for the export of fruit unless it is of the size and measurements specified in column two of the Second Schedule to this Act and a case or half-case of such size and measurements shall for the purposes of this Act be deemed to have the capacity specified respectively in column three of the said Schedule.

Size of cases for export.

2nd Schedule.

(3) No allowance for shrinkage will be permitted for cases used for export of fruit.

No shrinkage allowed for cases for export.

(4) The foregoing provisions of this section shall not apply to fruit exported from Victoria to any State of the Commonwealth of Australia or to New Zealand.

Not to apply to fruit exported to other Australian States or New Zealand.

Case to show
maker's name
address and
guarantee.

6. (1) No person shall sell fruit in a case or export or attempt to export from Victoria fruit in a case unless and until such case has been legibly and durably impressed printed or marked at each end on the outside of such case—

- (a) with the name and address of the maker of the case ; and
- (b) with the words “Guaranteed by maker to contain two imperial bushels” or “Guaranteed by maker to contain one imperial bushel” or “Guaranteed by maker to contain one-half an imperial bushel” as the size of such case may warrant.

2. The name address and guarantee as aforesaid of the maker of a case shall be legibly and durably impressed printed or marked at each end on the outside within a space measuring not more than three inches long and one and a half inches wide.

Enforcement of
Act by Inspec-
tors, &c.
No. 1432,

7. (1) Proceedings may be taken against any person who offends against any of the provisions of this Act—

- (a) by any Inspector under the *Vegetation Diseases Act 1896* (if so authorized by the Minister either generally or specifically) within any part of Victoria ; or
- (b) by any Inspector of Weights and Measures for any municipal district or union within such district or union ; or
- (c) in any municipal district for which there is no Inspector of Weights and Measures by any Inspector of Stock if so authorized by the Governor in Council by notice published in the *Government Gazette* ; or
- (d) in any part of Victoria by any member of the police force.

(2) For the purpose of ascertaining whether the provisions of this Act are being complied with any Inspector or any member of the police force as aforesaid may at any time board any vessel or enter any market shop store warehouse factory stall yard shed vehicle stand or premises whatever.

(3) In proceedings against any person for an offence against any of the provisions of this Act— Evidence.

(a) no proof shall be required of any order to prosecute or of the authority or appointment of any Inspector or of any member of the police force ; and

(b) it shall lie on the defendant to prove that in respect of any case the provisions of this Act have been complied with.

8. If any person—

(a) sells or exports or attempts to export or is concerned in exporting or attempting to export from Victoria fruit in a case in respect of which any of the provisions of this Act are not complied with ; or Penalty or Contravention.

(b) resists or wilfully obstructs any Inspector or any member of the police force as aforesaid in the course of carrying out any of the provisions of this Act ; or Penalty for obstructing Inspector, &c.

(c) refuses to give information or wilfully or knowingly gives false information in answer to any reasonable inquiry made by any Inspector or any member of the police force for the purposes of this Act ; or

(d) places or permits or causes to be placed on a case a guarantee that is incorrect or untrue or sells or exports or attempts to export or is concerned in exporting or attempting to export from Victoria fruit

in a case on which there is an incorrect or untrue guarantee

he shall be guilty of an offence against this Act and shall on conviction be liable to a penalty of not more than Five pounds for a first offence and of not less than Two pounds or more than Fifty pounds for every subsequent offence.

Penalties for
altering or
tampering with
cases or brands.

9. If any person alters the size of or tampers with any case bearing the maker's name address and guarantee or wilfully defaces or alters or tampers with the maker's name address or guarantee he shall be liable on conviction to a penalty not exceeding Fifty pounds or to be imprisoned for any term not exceeding twelve months.

Regulations.

10. (1) The Governor in Council may make regulations with respect to any matters whatsoever (not contrary to the provisions of this Act) necessary or desirable for the purpose of giving effect to this Act.

Publication.

(2) All such regulations when made by the Governor in Council shall be published in the *Government Gazette* and when so published shall have the force of law and shall be judicially noticed and shall be laid before both Houses of Parliament within fourteen days after the same shall have been made if Parliament be then sitting and if not then within ten days after the next meeting of Parliament and a copy of any proposed regulations shall be posted to each Member of Parliament at least twenty-one days before such regulations are approved by the Governor in Council.

SCHEDULES.

Section 4.

FIRST SCHEDULE.

SIZES, MEASUREMENTS, AND CAPACITIES OF CASES.

COLUMN 1 Case	COLUMN 2. Measurements	COLUMN 3. Capacity
Double-case	Twenty-six inches long, twelve inches broad, and fourteen and a quarter inches deep, by inside measurements and clear of all or any divisions	Not less than two imperial bushels or cubical content of four thousand four hundred and forty-six (4446) cubic inches
Single-case	Twenty-six inches long, six inches broad, and fourteen and a quarter inches deep, by inside measurements and clear of all or any divisions ; or Eighteen inches long, eight and seven-eighths inches broad, and fourteen inches deep, by inside measurements ; no divisions shall be allowed in such case	Not less than one imperial bushel or cubical content of two thousand two hundred and twenty-three (2223) cubic inches Not less than one imperial bushel or cubical content of two thousand two hundred and thirty-seven (2237) cubic inches
Half-case	Twenty-six inches long, six inches broad, and seven and one-eighth inches deep, by inside measurements and clear of all or any divisions ; or Eighteen inches long, seven inches broad, and eight and seven-eighths inches deep, by inside measurements ; no divisions shall be allowed in such case	Not less than one-half of an imperial bushel or cubical content of one thousand one hundred and twelve (1112) cubic inches Not less than one-half of an imperial bushel or cubical content of one thousand one hundred and nineteen (1119) cubic inches

SECOND SCHEDULE.

Section 5.

SIZES, MEASUREMENTS, AND CAPACITIES OF EXPORT CASES.

COLUMN 1 Case	COLUMN 2. Measurements	COLUMN 3. Capacity
Single-case	Eighteen inches long, eight and seven-eighths inches broad, and fourteen inches deep by inside measurements ; no divisions shall be allowed in such case	Not less than one imperial bushel or cubical content of two thousand two hundred and thirty-seven (2237) cubic inches
Half-case	Eighteen inches long, seven inches broad, and eight and seven-eighths inches deep by inside measurements ; no divisions shall be allowed in such case	Not less than one-half of an imperial bushel or cubical content of one thousand one hundred and nineteen (1119) cubic inches

REPORT FROM CHIEF FRUIT INSPECTOR.

FRUIT DIVISION, GOVERNMENT COOL STORES,
FLINDERS STREET, MELBOURNE.

22ND JUNE, 1908.

MR. C. FRENCH, F.L.S.,

Government Entomologist,

SIR,

I have the honor to furnish herewith, as you requested, an additional report *re* the work of inspection at the wharves, markets, etc., under the "Vegetation Diseases Acts," and also to render a brief outline of the amended Acts since the original one was passed, and also the general effect of same.

Since the issue of Part III. of "The Destructive Insects of Victoria," additional legislation dealing with the treatment of insect and fungus diseases of fruit and plants has been passed. As will be remembered, the original Act, No. 1432, was only a tentative measure intended to remain in force for a term of three years until its beneficial effects (or otherwise) were made manifest. At the expiration of that term, the benefits derived by the passing of this legislation were so apparent that a small Bill to continue the original Act indefinitely was brought before the House and easily passed. It was found that in the old Act provision had not been made for one phase of the subject which was very essential to the proper administration of this form of legislation, viz., the inspection of diseased fruit in markets. An amended Act, No. 1773, was therefore passed on the 23rd December, 1901, dealing with this aspect of the question. Under its provisions no person is allowed to sell, attempt to sell, or expose for sale, any diseased tree, plant or vegetable. Clauses were also included empowering Inspectors to seize diseased trees, plants or vegetables; both locally sold, imported or introduced. Power was also given Inspectors to enter any market, stall, shop or place, or any vehicle or stand, for the purpose of examining trees, plants or vegetables. Clauses were also introduced empowering the destruction of any such diseased trees, plants or vegetables, subject to the approval of the Minister or the expressed consent of the owner. Penalties were also provided for the contravention of any of the Sections of this Act up to £10.

As stated previously, in view of the danger of the introduction of fruit fly and kindred pests, it was thought necessary to more rigidly examine imported consignments of fruit and plants. As this, however, would entail many additions to the staff, and consequent

additional expenditure, a further amended Act was passed (No. 2050) on the 28th December, 1906. The manner in which this has affected the importation of fruits and plants has already been touched upon. This amended Act, however, contained other Clauses besides that of authorising Inspectors to charge fees; the principal ones being Clause 3, Sub-Clause 1, which empowers any principal officer of the Department of Agriculture, under a special order from the Minister, to give any direction, or to sign, or exercise any authority which he (the Minister) possesses. This was done in order to facilitate the administration of the carrying out of the Regulations during the Minister's absence. Another important Section was Section 5, which gave the necessary authority to an Inspector, under a General Order from the Minister, to exercise any powers given under Section 7 of Act No. 1532. It also gave the Minister power to appoint an Inspector temporarily for this purpose. Power was also given to the Minister, under this Section, to cancel any such appointment. It is now generally admitted that beneficial results have accrued consequent on the adoption of this legislation, which is evidenced by the total absence of any further outbreaks of fruit fly in the State during the season 1907.

The following are the insect and fungus diseases gazetted:—

INSECTS.

SCIENTIFIC NAME.	COMMON NAME.
Acarid	Maori.
Aspidiotus rossi	Black Flate Scale.
Aspidiotus coccineus	Red Scale.
Aspidiotus ficus	Fig Scale.
Aspidiotus perniciosus	San Jose Scale.
Aspidiotus nerii	Oleander Scale.
Athriostoma undulata	(No common name.)
Bruchus chinensis	Chinese Weevil.
Bruchus emarginatus	Margined Weevil.
Bruchus pisi	Pea Weevil.
Caecocercia responsana	Light Brown Apple Moth.
Calandra granaria	Grain Weevil.
Calandra oryzae	Rice Weevil.
Carpocapsa pomonella	Codlin Moth.
Cecidomyia destructor	Hessian Fly.
Cecidomyia oryzae	Rice Fly.
Chionaspis citri	White Scale or Louse of Orange
Chionaspis eugeniae	White Mussel Scale.
Dacus tryoni	Australian Fruit Fly.
Halterophora capitata	European or Mediterranean Fruit Fly.

<i>Heliothis armigera</i>	...	...	Tomato Moth.
<i>Heterodora radicicola</i>	...	...	Root-knot Eelworm.
<i>Heterodora schactii</i>	...	...	Beet Eelworm.
<i>Icerya purchasi</i>	...	...	Cottony Cushion Scale.
<i>Leptops hopei</i>	...	...	Apple Root Borer.
<i>Lecanium oleae</i>	...	...	Olive Scale.
<i>Lita solanella</i>	...	...	Potato Moth.
<i>Lonchea splendida</i>	...	...	Mettallic Tomato Fly.
<i>Mytilaspis citricola</i>	...	...	Mussel Scale of Citrus Fruit.
<i>Mytilaspis gloveri</i>	...	...	Glover's Scale.
<i>Mytilaspis pomorum</i>	...	...	Mussel Scale of Apple.
<i>Myzus cerasi</i>	...	...	Black Peach Aphis.
<i>Phylloxera vastatrix</i>	...	...	Phylloxera of Vine.
<i>Schizoneura lanigera</i>	...	...	Woolly Aphis.
<i>Selandria cerasi</i>	...	...	Pear Slug.
<i>Tephritis tryoni</i> (see <i>Dacus</i>)	...	...	Australian Fruit Fly.
Trypetidae	...	...	All Fruit Flies.
<i>Tylenchus devastatrix</i>	...	...	Ear-cockle Eelworm.
<i>Tylenchus tritici</i>	...	...	Stem Eelworm.

FUNGI.

SCIENTIFIC NAME.	COMMON NAME.
Cladosporium carpophilum ...	Peach Freckle.
Exoascus deformans	Peach Leaf-Curl.
Fusicladium dendriticum ...	Black Spot of Apple.
Fusicladium pyrinum ...	Black Spot of Pear.
Phyllosticta circumscissa ...	Shot-hole of Apricot.
Phytophthora infestans ...	Irish Blight of Potato.
Phoma citricarpa	Black Spot of Citrus Fruit.
Puccinia pruni	Prune Rust.
Melanose	Melanose.
Bitter pit (Abnormal condition)	Bitter Pit.

NOTE :—An abnormal condition caused by the above diseases is also a disease under the Act.

In all, there are 37 insect, 9 fungus diseases, and the abnormal condition known as "Bitter Pit."

The following are the chief Regulations under the different Acts :—

(See printed sheet marked "No. 1" herewith.)

Many additional proclamations have been issued since the publication of Part III. of "The Destructive Insects of Victoria." These deal chiefly with the proclaiming of each insect and fungus

disease as it is added to the list. It is necessary that this be done according to Section 12, Sub-Section 1, of the original Act, No. 1432, 1896. The more important ones relate to the total prohibition of certain plants; for instance, in view of the prevalence of the Potato Blight in New Zealand, it was thought necessary to totally prohibit potatoes from that country. The mangoe also was, for a while, totally prohibited entry into this State. This was done to minimise the danger of the introduction of fruit fly from Queensland, as this class of fruit was commencing to be imported in large quantities, and was being sold in barrows in the streets of the metropolis. Since then, as the new system of inspection of imported fruits is so thorough, it has been considered advisable to remove this restriction.

In brief, the following is a list of trees and plants which are prohibited, subject to the Regulations :—

(See printed sheet marked "No. 2" herewith.)

As this includes all parts or products of the foregoing, the wide range of the different trees, plants and their products, which the work of inspection embraces, will be realized. It is very necessary that this should be so in order to prevent the introduction, or the possible introduction, of diseases, which are, as yet, unknown in this State, and which, if introduced, might sound the death knell of the livelihood obtained by many in the cultivation and sale of the products enumerated above.

The proclamations dealing with these different trees, plants and vegetables are not necessarily uniform in their action, but have had to be modified to suit the tree, plant or product to which they may be applied. For instance, the regulations dealing with the importation of bananas and citrus fruits from Northern ports are more elaborate than those dealing with any other class of fruit or plants. This is necessary to prevent the introduction of those enemies which orchardists have most reason to dread, viz., the various species of fruit flies. These fruit flies, being almost ubiquitous, may be introduced in fruit coming from nearly all fruit-producing countries of the world. Therefore, it has been thought necessary to proclaim every known species under one drag-net proclamation. This has been done, and Inspectors may now seize and destroy fly-infested fruit from any country whatsoever.

I am, Sir,

Obediently yours,

E. MEEKING,

pro Senior Inspector, Fruit Exports and Imports.

PLATE LXV.

“MEDITERRANEAN FRUIT FLY” (*HALTEROPHORA CAPITATA*,
WIEDMANN.)

Fig.

1. Fly. Natural size. From nature.
2. Fly. Magnified. From nature.
3. Larva. Natural size. From nature.
4. Larva. Magnified. From nature.
5. Pupa. Natural size. From nature.
6. Pupa. Magnified. From nature.

“QUEENSLAND FRUIT FLY” (*DACUS TRYONI*, FROGGATT.)

Fig.

7. Fly. Natural size. From nature.
8. Fly. Magnified. From nature.
9. Larva. Natural Size. From nature.
10. Larva. Magnified. From nature.
11. Pupa. Natural size. From nature.
12. Pupa. Magnified. From nature.
13. Peach infested with lavæ. From nature.
14. Fruit Fly from New Hebrides. Natural size. From nature.
15. Same, magnified. From nature.



C.C. Brittlebank Del. C. French Direct.

Osboldstone & Co., Print.

CHAPTER LXXII.

FRUIT FLIES.

THE MEDITERRANEAN FRUIT FLY.

Halterophora capitata. Wiedmann. (*Diptera.*)

This terrible scourge of the fruit grower is becoming but too familiar in Victoria, the larvæ having been found in peaches, pears, quinces, apricots, plums, nectarines, guavas, oranges, lemons, apples, citrons, loquats, mangoes, pumpkins, bananas, tomatoes, pineapples and persimmons; so that it will easily be seen that hardly any fruit can be said to be exempt from its attacks, and of all the fruit grower's enemies the fruit fly is undoubtedly the worst.

As this work is written especially for the growers, technical terms and descriptions are avoided where at all possible, so that the colored plate drawn from nature will be the more easily understood. Unfortunately for Victoria, we are now having a very practical experience of this pest. Numerous cases have occurred, so far most of them in private gardens in the northern districts of our State. The danger has, we hope, been grappled with, and the pest—at least partially—stamped out by the adoption of drastic measures.

One great danger lies in the fact that many well-intentioned persons suppose, or profess to suppose, that fruit flies will neither live nor thrive in Victoria. This is a most mischievous, as well as a dangerous, theory, as the writer knows from actual experience that in Victoria the larvæ and also the flies will live for weeks exposed to the air by day and night, during both summer and winter; and, as showing the vitality of the larvæ, these have been kept by Mr. Fuller, Government Entomologist of Natal, for over three weeks in a freezing chamber, and at the expiration of this time the perfect insect has been

reared. It is to be hoped that none but the most careful will try to rear these flies artificially, for should this pest obtain a footing, which is extremely probable, the fruit grower will have to pack up and be off, there being, at present, no known remedy. But nature may provide, in the shape of some parasite, a means by which the fly may be kept in check if not stamped out altogether!

In writing of the above insect, Mr. Froggatt, Government Entomologist of New South Wales, who, with Mr. Tryon, of Queensland, has had constant opportunities of watching fruit flies in the orchards and elsewhere, remarks that this fly is quite a modern importation, as it was not until 1897 that it was discovered in orchards near Perth in Western Australia, and shortly after this Mr. Froggatt found them flying about in the breeding jars from peaches supposed to be infected with the Queensland Fruit Fly (*Dacus tryoni*) which had been obtained at the Sydney Fruit Markets. Mr. Froggatt further remarks, in his valuable treatise *Notes on Fruit Maggot Fly*, "That, though previously unknown in the Colonies, it had a well known record in Europe as far back as 1826, when it was described by Wiedmann as an orange pest, under the name of *Citriperda capitata*; and a few years after by Macleay, who published a large colored plate of the perfect insect. In this paper he, Mr. Macleay, stated that fully one-third of the oranges shipped to London from the Azores were rendered unfit for use before reaching their destination through the presence of this maggott when they were packed.

"Early in 1890, an article appeared in a publication known as *Insect Life*, where the fly was described and figured as a peach pest in the Bermudas. It was said to attack green and half-ripe peaches and mandarins most, and one correspondent reported that the larger oranges were not attacked.

"In 1892, J. H. Cook gave an account of the Orange Fruit Fly, in Malta. He stated that the whole of the

oranges had been destroyed during the last two years by this maggot, and that a Commission had been appointed by the Governor to report on the best means of checking this pest. In the following year a pamphlet was published in the *Mediterranean Naturalist*, by Professor N. Tagliaferro, at the expense of the Agricultural Society of Malta to give the orange growers a popular account of the fly. He advised them to 'smear a few oranges on each tree with honey, so that the adult fly would in gathering round them be caught and destroyed.' "

Miss Ormerod, in *Notes and Descriptions on a few injurious Farm and Fruit Insects in South Africa*, records *Halterophora capitata* as one of the serious pests of the fruit growers in South Africa.

In Malta, as has already been stated, we are informed that the Mediterranean fly does great damage to the orange crops, and, according to the Revd. Mr. Henslow, its attacks appear to be confined to oranges alone.

In a late number of the *Agricultural Journal of the Cape of Good Hope*, Mr. Lounsbury gives an account of how the trees are netted to protect the fruit from these flies. But, unless fruit is much more valuable than it is at present in New South Wales, it would not pay to treat the trees in this manner, as he says it costs about 3s. per tree to protect them by this process from the flies.

Mr. Fuller, formerly an Australian, but now Government Entomologist of Natal, gives the following account of the habits of this insect, as observed by him, and which was for some time known to us in Victoria as the West Australian fruit fly:—"The eggs are laid in the fruit by the female fly, and the larvæ are soon hatched from them and commence feeding. When they are full grown the maggots leave the fruit and enter the soil to pupate, that is to change into the last stage prior to their emergence from the soil as perfect insects, and great numbers are carried to the ground by the falling

fruit. After having rested in the soil as papæ for about twelve days the flies hatch and make their way to the surface and continue their destructive work."

The following is an account of some experiments, dealing with the Mediterranean fly, which were carried out by the Assistant Entomologist (Mr. C. French, jun.) and myself during 1906. The results of similar experiments made by Inspector Farrell at my request are also given.

The larvæ of this fly were found in bananas imported from Queensland on the 14th August, and, on being placed in the breeding jars, pupated on the 20th August; the perfect insects emerged on the 4th October and lived for several weeks; water, with a little sugar added, being the food placed at their disposal. Larvæ were detected in oranges from Maryborough (Queensland) on the 19th September, and pupated on the 24th September; the perfect insects commenced to emerge on the 26th October, and continued emerging till the 30th. On the 2nd November several cases of Seville oranges were sent from Sydney. These were badly infested with larvæ of the Mediterranean fruit fly; on being placed in the breeding jars they pupated on the 6th November, and the perfect insects were hatched out on the 3rd December. No less than sixty flies were hatched from two Seville oranges, and the perfect flies lived ten days without food. The Mediterranean fly has also been reared from tomatoes sent from Queensland. The larvæ of the fly curl up and by a muscular movement jump fully one foot. I placed various fruits with these flies, but could not get them to deposit eggs in them.

These flies are very active at night if exposed to light, and possibly might be attracted by placing a lamp amongst the trees, the lamp to be placed in kerosene.

Inspector Farrell reports the results of his investigations in connection with the Mediterranean Fruit-Fly and its habits as follows:—"I placed fully-grown larvæ in a jar on the 12th February. Flies hatched out on

the 25th, *i.e.*, thirteen days later. These were placed in a tin box containing some earth and covered over with a mosquito curtain; sliced tomatoes and peaches was put in with them, and the box was left out in the open air. Flies fed on the tomatoes, but punctured peaches and deposited eggs in them. The flies died on the 21st March, twenty-five days old. Other flies which were hatched out on the same day, but got no food, died on the 1st March, four days old. I reared from the peaches a number of larvæ which went into the chrysalis state on the 15th March, and I expect them out on the 30th or 31st March.

On the 15th March I saw a fly on a peach in Constable Collins' garden. The fly must have just laid. I secured the peach and kept it under observation. At first there was no puncture visible, but afterwards one became pronounced. I reared five larvæ from this peach; these were fully grown on the 25th March and went into chrysalis on that date.

In connection with egg-laying I find that from four to seven eggs are laid in each puncture or chamber, and not alone does the fly puncture the fruit, but it also constructs an oval-shaped chamber which is apparently lined with a tough brownish substance. Mr. Carmody and I, at Numurkah, found four tiny elongated eggs of a dirty white colour, and these, when seen under the lens, shone similarly to the body of a young larva. The eggs lay parallel to each other, and occupied about half the capacity of the chamber. The young larvæ hatched out on the following day, but we did not succeed in rearing them. I have found four larvæ each in a number of peaches which had apparently only one puncture each. I have also found twelve larvæ in peaches where only three punctures each were visible. Then again I have found five, six, and seven larvæ in peaches, each of which have apparently only one puncture, but I have never found less than four larvæ in any peach. Therefore it is only reasonable to conclude

that from four to seven eggs are deposited in each chamber, and that four are more frequently laid than any other number. Flies are apparently not fit to lay until they are four days old.

An analysis of the above will show :—

1st.—That from the time the egg is laid until larva is fully grown is 12 days.

2nd.—That the chrysalis stage is 13 days.

3rd.—That the life of the perfect insect, when fed, is 24 days.

4th.—That from the time the egg is laid until the insect which it contains dies of old age is 50 days.

5th.—That, when the fly is not fed, the 50 days are reduced to 29 days.

I have not been able to determine the term of the eggs' incubation."

In Western Australia, Mr. Fuller remarks, "The fruit is attacked directly it begins to sweeten and before it ripens, green fruit being seldom if ever attacked. The eggs are laid in the fruit by means of a very sharp needle-like organ called the ovipositor, borne on the extremity of the abdomen of the female. The maggots are soft, yellowish white in colour, somewhat shining and limbless worms, and somewhat resemble those of the meat fly. The pupa and chrysalis are oval and stout, at first a golden yellow but subsequently changing to a reddish brown. The flies are pretty little insects with two wings only, about half the size of the common house fly. They have very large and lustrous eyes, the thorax is mottled with grey and black, and the abdomen is of a brownish yellow and crossed by thin stripes of a silvery grey colour. The wings are large and simple. They are transparent, strongly veined, and marked by several clouded bands of grey and yellow colour. In walking, the fly always carries its wings in a drooping attitude. It is a very difficult thing to find the fly in an infected orchard, although they may be present in large

numbers. If, however, a maggoty peach be put aside in a box for a few weeks the flies can be reared and easily observed."

It has been frequently stated in Queensland and New South Wales that the flies will not attack green fruit. This is a mistake, as I have on many occasions proved eggs to have been deposited in green bananas before shipment, as no half-ripe bananas are ever shipped from Queensland to Melbourne. This fly would appear to be more numerous than are the other kinds here mentioned. No less than 60 adult specimens have been reared at our office from two specimens of the bitter or Seville oranges, which had been sent from one of the northern ports of Queensland. The indications of the presence of the fruit-fly larvæ in such fruits as the citrus family are, although easily detected by the practised eye, upon the whole not well defined. The skin of oranges, lemons, and limes being more or less of a rough granulated texture renders the task of finding the infected fruit, where large consignments have to be handled, by no means an easy one.

In Victoria, at least, it is astounding with what rapidity this fly destroys the fruit in the orchard, only a few days, in the case of peaches, elapsing before the whole of it is rendered unfit for human consumption, the fruit being absolutely decomposed and discolored. In Victoria, our experience has taught us that the first fruit to be attacked are apricots, then peaches, then, as the broods hatch from the ground, other fruits, as apples, pears, persimmons, &c., are attacked in succession. From observations made in the field (I am speaking of the north-east part of Victoria), the trouble has been traced through the medium of imported fruits, bananas and oranges especially, infected fruits of both kinds being commonly obtainable in Melbourne, the suburbs, and in the country townships. Those who have carefully studied the habits of the fruit-fly are aware that its flight is but short, and judging from its

habits in our Victorian orchards it would appear that the fly does not favour long distance journeys, although, as with other kinds of short flight insects, it would be possible for this pest to fly or be even blown across the Murray. This is, of course, a mere surmise; but the fact of the grubby fruit being even obtainable in Melbourne and elsewhere, goes to prove how necessary are the extra precautions now being taken by the Department. As one who has seen the fly at work both in New South Wales and Queensland, I assert that the ravages of the Mediterranean fly in Victoria are quite as bad as either the Queensland or New South Wales experiences have been able to record, half-green peaches being attacked as badly as those either ripening or ripe. The perfect Queensland fly has not, so far as we are aware, made its appearance amongst us, and we sincerely trust it may not do so.

Referring to the life history of the Mediterranean fly as observed in Victoria, the female insect punctures the skin of the fruit when the latter is in the condition of being half-grown, hard and green to that of ripe or ripening fruit, and, by means of ovipositor, places from five to fifteen eggs in each fruit. These hatch out in a few days, the maggots remaining in the fruit for about fourteen days. The fruit then drops to the ground, and the maggot or grub enters the earth to the depth of a few inches, and there assumes a chrysalis form, from which the fly emerges in from 14 to 20 days, according to the climatic condition. In a climate like Victoria, it is thought possible, taking the succession of fruits into consideration, that we may have a fresh brood for nearly seven months in the year. It has been questioned by some persons whether this fly is found in Queensland at all, but the fact of it having been reared by us from bananas and oranges from Maryborough places the matter beyond the shadow of a doubt. If such be not the case, then the fruit must have been affected during transit, a theory which I, for one, will not entertain.

QUEENSLAND FRUIT FLY.

Dacus (Tephritis) tryoni. Froggatt. (Diptera.)

This most formidable pest, formerly known by the name of *Tephritis tryoni*, Froggatt, is one of the greatest pests with which the fruit-grower has to contend. Messrs. Tryon and Froggatt have gone to a deal of trouble in investigating the life history of this wonderfully destructive little fly, thereby giving southern growers great assistance in the matter of its life history, &c.

This fly is the common species all over the fruit-growing districts of Queensland, the northern rivers and the New England districts of New South Wales. It may probably come into our State in either of two ways. First through the agency of infected fruit sent by sea, or it may be sent overland in fruit, although the latter risk is much the more unlikely than that of the former, and is merely surmise, the importation by sea having over and over again been proven.

Second-hand fruit cases, a prolific source of danger, get scattered amongst the orchards, and the fly may rapidly spread from a number of different centres. Mr. Froggatt says "I have seen fruit cases from Ryde stacked up behind a shed on the Manning River, and at Wallerawang on the Western line. I saw hundreds of cases at a Chinaman's hut branded with the names of a score of different orchadists' names from all parts of the county of Cumberland. Now, when specimens of fruits arrive at the office from any distance, I invariably find that the maggots have crawled out of the fruit and have pupated among the paper in which it has been wrapped. The little hard chrysalis adheres to the paper, and this would naturally follow if infested fruit were allowed to remain for any length of time in the case; the pupæ would stick to the sides of the case, until it was returned or left in new quarters, and, when hatched, would infect the district.

The only specimens of these species that have been bred in our office are those in over-ripe or decaying bananas, and other northern fruits that have been condemned on our wharves, and would, before our regulations came into force, have been sent all over the back country. I am therefore of the opinion that the reason why this fruit-fly has not been found close into Sydney is that the spread of diseased bananas has been controlled by our fruit inspectors. The maggots are always found in over-ripe or decaying fruit or cracked bananas, and these are the ones that should be discarded as soon as the bunches are looked over. When the inspection of fruit first came into force, it was stated that the fruit-fly bred in the decayed stalks of the bananas; but when these maggots were placed under observation, they proved to be very distinct and harmless larvæ producing slender and long-legged flies belonging to another family.* The chief distinction between this and other fruit-fly maggots is that the fruit-fly has two rows, on either side of the last segment, of little spiral reddish-brown processes (anal respiratory tubes). They all have the same cylindrical body thickening towards the tip, and the same curious black toothed mandibles. The perfect fly has clear transparent wings, with stout reddish nervures, and the general colour is reddish-brown with yellow markings. The body with its tapering waist and pointed body gives it a somewhat wasp-like appearance."

Mr. H. Tryon, Government Entomologist of Queensland, has had exceptional opportunities of observing the habits of this fruit fly, and, as we require all possible information of a reliable character concerning this pest, I quote Mr. Tryon's remarks on his personal observation in the natural home of this particular species of fly, as also of the same insect when in confinement.

Mr. Tryon says "The eggs of this species are just large enough to be seen upon a dark background by the

*We have found the larvæ of the true fruit fly in the rough end of a banana stem.—C.F.

naked eye, the full-grown maggot being about four-tenths of an inch in length. A feature of this maggot not generally known is that it is an air-breather, and that, if air be excluded from the fruit, its inhabitants must die. The chrysalis is one-fifth of an inch in length, and exists in a partly comatose condition till it develops into the fly. The male is easily distinguished from the female, as the posterior of its body is rounded, while that of the female carries the ovipositor, the pointed projectile being used to pierce the skin of the fruit and deposit the eggs in the tissue. The ovipositor can place an egg one twentieth of an inch below the surface. When disturbed it does not fly far ; but tries to hide beneath the leaves, and for this reason often goes unobserved." Mr. Tryon concludes that the average life of the insect is about five weeks, and that each fly lay about a dozen eggs.

When fruit is easily punctured the fly distributes its eggs, though many (but occasionally eight), and even the whole batch, are placed in one fruit. It is not usual to find eggs laid in fruit before it is two-thirds grown, as the female seems to defer operating till a pleasant odour from the fruit is perceptible.

Regarding the periods of development at which the fruit is attacked, Mr. Tryon, together with Mr. Searle, furnished some reliable information. "The eggs take three days to hatch when under observation, but in the open air this will be hastened or retarded by climatic conditions. Occasionally the young grubs are killed because the growing fruit presses upon them, and in other cases the young are unable to break down the tough woody tissue of immature fruit. In mellow saccharine fruits all the eggs hatch out, and the grubs mature unless the tunnel becomes closed and excludes the air. In pip fruit and slipstone peaches the grubs can live nearer the centre, but in close stoned fruit they must work near the surface.

"The life of the grubs in the fruit is from two to five

weeks, occasionally less than two weeks. It invariably happens that when the grub has done feeding, it leaves the fruit, which has usually fallen to the ground. After leaving the fruit the grub usually tries to hide beneath the soil, sometimes going as deep as four inches, and then within twenty-four hours changes into a chrysalis.

"In summer a period of from seven to fourteen days elapses before the fly is out of the chrysalis, but in winter the lethargic condition continues much longer. There are several broods during the year, and from August to April (in Queensland and New South Wales) reproduction is virtually continuous; as females preponderate and as each lays twelve eggs, prodigious multiplication is the result. Occasionally the fly passes the winter as a perfect insect. The ability to breed throughout the year is due to the succession of fruits from loquats to oranges in winter."

Many larvæ of this fly reach Melbourne in bananas, oranges, cucumbers, &c., and have been reared by me. The habits are almost similar to those of the Mediterranean fruit fly, but the insects sometimes take longer to hatch. The majority of larvæ placed in breeding jars on 20th August pupated on 28th August, and emerged on 6th November; others took only six weeks to hatch, and lived sixteen days without food. Mr. E. J. O'Connor, of Ivanhoe, kept this fly alive for nine weeks by feeding it with oranges and water.

QUEENSLAND FRUIT FLY.

Variety cucumis. French.

I have given the above name provisionally to the fruit fly reared from cucumbers sent from Bowen (Queensland). It is closely allied to the Queensland fly; but the well defined yellow bands on the abdomen are wanting; the whole color of the fly is much lighter in appearance, and the pupa-cases are a little larger. The larvæ are of a deeper color than those of the ordinary

Queensland fly, and no less than fifty-eight larvæ were taken from one cucumber. The maggots were received from Queensland on 22nd October, and pupated on 25th October. The perfect insects, which emerged on the 21st November, lived only twenty-four days, whereas the Queensland flies will live for weeks. The larvæ of this fly also have the peculiar habit of curling up and jumping, beating badly all previous records that I have observed of the jumping propensities of fruit fly larvæ.

THE GUAVA FRUIT FLY.

Tephritis psidii.

I am indebted to Mr. Tryon for museum specimens of this fruit fly; and which I have not seen in its living state. In dealing with this insect Mr. Froggatt remarks: "The fly was bred out on the 4th of April from some infected guavas, which had been condemned by Inspector Butler, who obtained them from a cargo from Noumea, New Caledonia. When the guavas were examined about a fortnight before, the maggots were very small, so that their development had been very rapid; probably a month would be long enough for the egg to hatch and evolve the perfect insect. The maggot did not appear to differ in any point from that of *D. tryoni*; but as they were examined in an immature state they may yet develop specific differences. The pupæ bury themselves in the soil just below the surface, and, when the pupa cases are empty, are light yellow, about two lines in length."

As we have no plate of this insect, I give Mr. Froggatt's description, as the pest may come here from the South Sea Islands.

"Three lines in length, expanse of wings, $4\frac{1}{2}$ lines; head, light brown; eyes, rich metallic purple; antennæ, brownish yellow, with the last joint black, long and cylindrical, finely pubescent; the bristle springing from the apex of second joint, stout and long, and a few on the forehead and hind margin of the head. The thorax

black, finely shagreened with only a few hairs at the base of the wings; a pale silver-grey parallel band runs round the centre, with a pale yellow stripe on either side; the sides of the pro-thorax in front of the wings, and the sides of the meta-thorax marked with creamy white; the scutellum large, angular, broad in front, and thickly margined with pale yellow; a pair of stout black bristles standing out on the spiral margin; the legs brownish yellow, clothed with very fine hairs; tarsal spines and claws black. The wings are hyaline, very slightly clouded at the extreme tip; nervures black; the transverse cubital nervure clouded on either side with black, giving it a thickened appearance: the apical portion of the second costal, the base of the third costal, and the third basal cell clouded with brown. The abdomen turbinate, very narrow at the waist, elongated, widest in the centre and tapering to the extremity, ovipositor consisting of a stout horny process enclosed in a pale yellow sheath, showing a granulated structure."

THE NEW HEBRIDES FRUIT FLY.

Our plate shows figures of a fruit fly said to be very destructive to bananas and other soft fruits growing in the New Hebrides. The fly, as will be noticed in figure 14 is larger than any of the other fruit flies here mentioned, and particulars as to its identity will be welcomed by economic entomologists both in Australia and elsewhere.

PREVENTION AND REMEDIES.

In dealing with the subject of fruit fly prevention and remedies, it should be understood that our first care should be to keep out the pest if at all possible to do so, and no measures, however strong they may be, should be disregarded. The great danger of introducing fruit flies into this State is, first, through the agency of shipping consignments from infested areas; and secondly, through the medium of fruit sent by rail to some of our Northern

districts, where, owing to a congenial climate, the pest would surely spread with great rapidity, and the absolute ruin of many of our fine orchards would speedily follow.

The fruit flies, as far as we are aware, have not become permanently established in Victoria, but it would be well to see what others, who have been less fortunate in this respect, have done towards the well-nigh hopeless task of eradication. I am again indebted to Messrs Froggatt and Tryon, and others, for the results of their experiences in this direction. The remedies referred to by Mr. Tryon I am inclined to agree with, and amongst other methods mentioned in the preventive stage, that is, to protect uninjured fruit from attack, I may quote the following:—

In Western Australia, the plan of placing kerosene boxes, in which kerosene has been placed, in the trees, has, so I am informed, produced the best results, no fewer than some thousands of the flies having been captured by these simple and inexpensive traps. Another method as supplied to me is as follows:—"Place three or four small tins (sardine tins being the best) in each tree, and pour a little kerosene in them. Let the tins be on an incline so that a portion of the bottom of the tin is bare, or free from kerosene. A good plan is to nail the tins by the lids left on the one side to the trunks and branches. 'The kerosene seems to attract the flies.'"

All fallen fruit should be destroyed by burning or boiling, in order to prevent the larvæ from going into the ground to change into the perfect insect; if this is not done immense numbers of flies will be bred from the infected fruit. Fine netting may also be used to cover a few trees, but this in large orchards would, of course, be too expensive.

The flies can no doubt be kept away also by offensive odours of different kinds, as preparations of tar, carbolic acid, &c., but this latter could only be done some weeks before the fruit ripened. Mr. Tryon also recommends that wood-tar smeared on pieces of rag or tan and hung

suspended in trees, be adopted ; and I have no doubt as to the value of this recommendation. The Italians have mixed wood-tar with soda crystals, making a perfect solution for spraying, a system which Mr. Tryon informs me has lately been published.

The shelly covering of the chrysalis renders it practically impervious to any liquid application, but if the ground is dug up or raked, so that the chrysalis is exposed, it dries up and dies. When the fruit drops to the ground, it is virtually caught in its own trap. Then is the orchardist's opportunity. If the infested fruit is gathered at least daily and destroyed, the development of another batch of flies is prevented. Burning or scalding would be most effective, but, as this is not always a convenient method, it would be well to keep an open trench about three feet deep in which the fruit should be buried and a covering of the earth rammed down.

Another effective way, as Mr. Tryon thinks, would be to place between the trees some caustic substance which would destroy the tender maggot, and he has found ordinary gas-lime and muriate of potash very efficacious. Gas-lime should be spread to a depth of one inch.

Dr. Cobb, who has had many opportunities of dealing with the pest in New South Wales, is not enamoured of the system as above recommended, and counsels constant cultivation so as to kill the grubs and papæ below ground.

Finally then, the only effectual plan is to carefully examine the growing fruit, also any which may be sent to the Melbourne markets from affected areas. In the case of growing fruit, the trees should be examined as often as possible, especially when near the time of the fruit changing color for ripening. Upon examining ripe fruit, peaches especially, very close observance will be necessary, as the indications to even a trained eye are most difficult of detection. Should any outward signs present themselves, either as punctures or premature

decay, cut some of the fruit in halves, and, if the maggots be present, the damage will be disclosed.

In speaking of trapping and other methods Mr. Froggatt says, "Professor Tagliaferro's method of smearing some of the ripening fruit with honey has been noted before. One of the most practical traps, in which the experimenter tells me he captured numbers of flies every night it is set, has been used by Mr. L. Saunders, of Ryde, New South Wales, who places a lamp or candle in a tin surrounded with a few inches of kerosene oil and water under the infested trees, and though in their normal condition the flies rest at night, the unusual light attracts them, and coming round the light they fall into the oil and are smothered.* Prevention is better than cure, however, and the royal remedy to get rid of the fruit fly maggot is to destroy at once all fallen fruit found to be infested.

"If all the orchardists would do as a friend of mine did in his orchard at Minto (New South Wales)—*i.e.*, gather all his late peaches and persimmons (over twenty-five cases) and boil them—they would find the first loss the least; for, as surely as the last autumn brood of fruit fly maggots is allowed to get into the soil of the orchard, unless we have an exceptional winter, so surely will we have the Mediterranean fruit fly playing havoc with the coming year's fruit in the county of Cumberland, New South Wales. Where the ground is well cultivated in winter, the chrysalis will be turned up and have less chance of producing fruit fly, as a very slight injury at this stage of their life will kill them.

"The insectivorous birds hunt for them, and where flocks of turkeys and fowls are available, if they are given the run of the orchard during the winter, they will scratch over the surface and destroy great numbers."

One of the principal matters to be considered, should the fruit flies ever obtain a permanent footing in our State, is to make ourselves acquainted with the symptoms,

* In captivity the flies are very lively, and are easily attracted by an ordinary gas light.—C.F.

both external and internal, present where fruit is affected, and although we ourselves have had much practice in detecting the larvæ in fruit imported into this State, the long experience gained by Mr. Tryon in the natural home of, at least, some of the fruit flies is well worth the trouble of giving to our readers.

“It not infrequently happens that the fruit on being gathered presents externally no evidence of its being infested with the maggot of the fruit fly, and this circumstance leads to parcels, after they have been sent to the markets as sound, being returned to the grower as entirely worthless. This we found to be a very common complaint at Toowoomba (Queensland), and to emphasize this general experience, Mr. R. Bushnell handed to us three peaches freshly gathered from the tree, and in quite a green state, at the same time challenging us to detect, without the most minute examination, any external sign of their being injured, and this we were unable to do. These peaches were delivered to us on the 28th January, and after they had been securely isolated, they were put aside for subsequent observation, and on the 18th February it was noticed that five fruit flies had bred from maggots with which they must have been infested at the time of our having first received them.

“Other fruit, especially the pear, often also appears quite sound too; though it has afterwards been found to be maggot eaten. Usually, however, there is some external indication—one side of a peach may appear dull green as if slightly bruised, and the surface of a pear or plum may exhibit at spots the appearances which would follow a similar injury to these fruits. At these places it will be found that the fruit is softer than at others, and that generally the juice will exude on pressure at one or two minute holes, which, however, in the case of the peach, may have been previously detected, especially when occurring in the lateral depression.

“At a later stage, these punctures, in each of which an egg has been deposited by the fruit fly, having

meanwhile been enlarged by other insects, may become conspicuous objects, and the more so when, as often happens, they are surrounded by altered brown tissue.

“It may happen, also, that the surface of the fruit may be rendered uneven, and this is especially so when the latter has been early attacked. The following description of an infested apple may be taken as an illustration :—

“In this case the surface of the apple appeared to have been stung all over, and although most of the holes caused by the punctures were now obliterated by the growth of the fruit itself, there was abundant evidence of the extent of the injury. The site of the puncture was marked by a minute dark spot, surrounded by a small halo of a darker green than was the general color of the unaffected parts ; these spots were each of them the centres of shallow depressions ; these depressions were sometimes confluent. In cases where the last condition prevails, or the depressions are largely developed on one surface of a fruit, this becomes very unsymmetrical in shape. It sometimes happens that pears and apples when still green and hanging on the tree develop well defined patches or spots of a coffee-brown color ; these are found to be deep-seated and to be attended by the presence of a fungus.

“In several instances of fruit so affected we have detected the maggot of the fruit-fly, by breeding the latter from such specimens, but in quite as many others have failed to do so, and this being the case we are not disposed to regard this canker-like disease as being due to injuries inflicted by this pest ; but such may afford the antecedent circumstances favorable to its establishment.

“An infected pear when cut through, though it may show no sign of internal injury, will exhibit numerous brown spots of different size, the sections of as many channels whose walls are composed of altered brown tissue, and which sometimes are the centres of much

more extensive injury. At other times a zone of brown tissue surrounds the core. In a peach or in a plum the maggot seems to find its way very quickly to the stone, and then to feed on the tissue immediately surrounding it, usually to a greater extent on one side than on the other, devouring the pulp, leaving the more fibrous material, and producing generally much semi-fluid matter as product of decay. In a free-stone peach the symptoms usually commence in the tissue immediately adjacent to the stone; but in a cling-stone the injury seems for some time to be frequently limited to the part opposite the lateral depression, and between it and the stone. Eventually all fruit which is attacked becomes a mere 'mass of corruption.' It is important to note, however, that the fruit maggot never attacks the pips or stone of a fruit, nor yet the rind."

Mr. Tryon further remarks: "It is the general opinion in the district (Toowoomba) that cultivation has no influence in protecting the trees from the visitation of these pests, nor have our observations led us to come to any other conclusion. The same may be said of neglect of cultivation, but in this we have the additional loss due to the fact that the fruit saved is of an inferior quality only."

Before concluding this article, it may be remarked that there have been many supposed cases of fruit fly damage within the State; but upon investigation the trouble has been found to have been caused by insects which have nothing in common whatever with the true fruit-flies, either in point of size or general appearance. When, however, we take into consideration the terrible ravages for which the real fruit-flies are responsible, (I am afraid to quote Mr. Tryon on some of these losses) it is no wonder that growers are on the alert, as they undoubtedly should be, and that upon the faintest suspicion of the pest in the orchard or elsewhere, it is earnestly hoped that the entomologist will be immediately communicated with, so that the pest may be tackled

promptly, as was done here on a previous occasion, also in Tasmania, where this scourge of the fruit-grower has been stamped out, let us hope for good.

The grave importance of the subject of the ravages of fruit-flies must be my excuse for having devoted so much space as is here allotted to it. I feel sure that as we are now called upon to face the fruit-fly difficulty, we are at least armed with the best experiences which have been obtained both in the orchard and in the field. The improved methods of examining fruit imported into our State, and which methods are now at our disposal, will without doubt minimize the danger of introducing, through the agency of fruit or cases, fruit-flies of any kind whatever.

The Mediterranean fruit-fly has now made its appearance in New Zealand, and when we know that this pest thrives in the elevated Armidale district of New South Wales, it is idle to suppose that it will not thrive in the comparatively genial climate of Victoria.

In conclusion, it may be pointed out that the use of second-hand fruit cases may become a prominent factor in the distribution of the fruit-fly throughout the State.

In dealing with the fruit-fly trouble now amongst us, the co-operation and assistance of all growers is solicited, and growers may rest assured that this new pest will receive no quarter at the hands of the Entomological Branch; we must rely upon the patriotism of growers in present unaffected districts to look with a friendly eye upon the apparent neglect for a time of more fortunate growers, as the Field Inspectors will have all they can do to prevent this pest from being firmly established in our State.

PLATE LXVI.

“WATTLE SCALE” (*PSEUDOCOCCUS ALBIZZIE*, MASKELL.)

Fig.

1. Insects on Wattle Branch. Natural size. From nature.
2. Female, with cottony cushion. Magnified. After Maskell.
3. Adult female, dorsal view. Magnified. After Maskell.
4. Larva. Magnified. After Maskell.



C. C. Brittlebank, Del.

C. French, Direxit.

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CHAPTER LXXIII.

THE DARK PURPLE WATTLE SCALE.

(*Pseudococcus albizziæ*, Mask.)

Order: Hemiptera.

Sub-Order: Homoptera.

Family: Coccididæ.

This formidable scale insect was found by myself destroying the plants of the so-called "Cape Wattle" (*Albizzia lophantha*) in and around Melbourne, and was submitted by me to that eminent specialist on scale insects, the late W. M. Maskell, of New Zealand, who determined it to be a new species, the specific name *Albizziæ* being given on account of its food plant being, as above stated, the Cape Wattle.

In general appearance the insects are black and white, but upon closer examination it may be seen that they are of a dark plum color, sometimes almost black, with a white margin, the adult females being covered with a cottony secretion (see Fig 2).

The larva, which is magnified on our plate, is a singular-looking creature, and at certain seasons of the year the larvæ simply swarm over the affected trees, and from thence are easily distributed by means of plants, and possibly by birds carrying the larvæ on their feet, from tree to tree.

When a tree is badly affected (and this insect is a deadly enemy of the "Black Wattle," *Acacia decurrens*) the branches become black and dirty looking, and, when left unchecked, the pests will soon kill the tree right out.

Swarms of ants frequent trees infested by this scale, these being attracted by the so-called "honey dew," a sugary secretion peculiar to many of the *Homoptera*, and present also in this species.

It will be noticed from the plate that the adult insects

are very thick on branches of the tree attacked, and even when the tree is either dead or dying the scale seem to retain their vitality; and it is only when the mature insects die, and the swarms of young scale take their places, that the tree which they have destroyed is abandoned to the wood-cutter.

Prevention and Remedies.

When planting wattles for commercial purposes, the young plants, on attaining a height of, say, five feet, should be well watched, and the vicinity of the plantation carefully examined for traces of this insect; and all old wattles, if in any way attacked, should be grubbed out and burned, in order to prevent a very probable contagion to the young and newly planted trees.

In the event of the insects having already commenced operations, spray at short intervals with kerosene emulsion, which material, if used in the spring, will kill off the young fry usually with the one spraying.

In selecting a site for a wattle plantation, avoid land which is at all liable to any stagnant moisture, a gravelly soil and sub-soil being the best; as, when the young plants once receive a check in their growth, they are all the more liable to insect attacks of all kinds.

Arrange for the planting to be in lands, leaving sufficient space for a horse sprayer to work comfortably between the rows, as the "fire blight" can also be dealt with by adopting the above plan.

Insect enemies of the wattle are both numerous and formidable, and it will well repay for the trouble and expense incurred to keep a careful watching during the early sapling growth.

Mr. C. French, Junr., my assistant, states that the Dark Purple Wattle Scale has also been found on orange trees, also on various species of *Acacia*, especially on *A. baileyana*. It is subject to the attacks of small parasitic *Hymenoptera*, which seem to keep it in check near Melbourne.

PLATE LXVII.

"THE APPLE TREE DESTROYER" (*PROSOPS PEDISEQUUS*,
BUCKTON.)

Fig.

1. Limb of Apple Tree, showing appearance when attacked; portion of bark, showing eggs; also perfect insects. Natural size. From nature.
2. Perfect insect, dorsal view. Magnified. From nature.
3. Perfect insect, ventral view. Magnified. From nature.
4. Perfect insect, ventral and dorsal view. Natural size. From nature.
5. Egg. Magnified. From nature.
- 5A. Eggs under bark. Magnified. From nature.
6. Head and proboscis. Magnified. From nature.
7. Funnel-shaped opening, made by female when depositing eggs. Magnified. From nature.
8. Leg of insect. Magnified. From nature.



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CHAPTER LXXIV.

THE APPLE TREE DESTROYER.

*(Prosops pedisequus, Buckton.)*Sub-Order: *Homoptera*.

Some time since my attention was directed to certain apple and other trees which were being rapidly destroyed, owing to some obscure insect having perforated both the upper part of the stem and branches. The locality from which I received the information was the Goulburn Valley, situated about fifteen miles from Numurkah. Upon receipt of this information I at once started for the purpose of ascertaining, if at all possible, some particulars of the culprits doing the mischief, also to devise some remedial measures.

I found the tree—a fairly large one—to have been perforated in all directions; and, upon folding over a piece of bark, found that the punctures, which had been used for egg laying, were plainly visible, as our plate shows, with the eggs in each puncture as shown in Figure 1. Amongst the branches certain small insects were captured; but, as it afterwards turned out, these were not the real culprits.

In the month of January, a well-known orchardist of Balwyn, Mr. Fankhauser, senior, called upon me with specimens of some of his trees which had been badly infested with what afterwards proved to be a homopterous insect, and the damage done was identical with that at Numurkah; so I sent the specimens to the well-known specialist, Mr. Buckton, in England, who at once recognised it as a new insect, and named it as above.

This insect deposits its eggs, from six to eight in number, in the punctures which it has made for the

purpose, the same, with other interesting matter, being shown on the plate accompanying this article. The punctures are placed in bead-like form, very close together, so that the branches of the tree are perfectly riddled with holes; the apertures, after the eggs have been deposited, being closed with a white flocculent matter.

Mr. Buckton remarks that many kinds of *Tettiigida* (which I may remark are allied to the *Cicada*) are known to ruin sugar canes in India and other tropical countries. It would appear that this is no new pest, as some of the older orchardists have assured me that many years ago the punctures on the dying trees had been observed, but the cause of the trouble had not been then determined. Unfortunately it has been ascertained that the natural home of this insect is in the wood of young gum-trees (*Eucalypti*), so that its exact range cannot well be estimated.

It is truly a pitiable sight to see a once magnificent tree ruined, or nearly so, by a so insignificant-looking insect, this being another bad example of an indigenous insect having abandoned its natural food for the more palatable fruit-trees of our own orchards.

It may be added that this was discovered by means of covering parts of the affected branches with muslin.

Prevention and Remedies.

In orchards spray with kerosene emulsion as a deterrent, as, if simply a weak spray be used, it would in all probability prevent the female from puncturing the bark for egg-laying purposes. If the orchard be situated near to a gum forest, the trees in the orchard must be carefully watched; but, should the pest get a foothold, spraying with resin compound would be the best remedy, the resin sealing up all the punctures, and thus the eggs will be prevented from hatching, and thereby lessening the number of perfect insects to continue reproduction.

PLATE LXVIII.

HUEBNER'S "CASE MOTH" (*HYALARCTA HUEBNERI*,
WESTWOOD.)

Fig.

- I. Twig of Eucalyptus, with cases constructed with silk and dead leaves. Natural size. From nature.
- II. Cases or bags containing larva. Natural size. From nature.
- IIA. Cases or bags containing larva. Natural size. From nature.
- III. Larva. Natural size. From nature.
- IV. Pupa, male. Natural size. From nature.
- V. Pupa, female. Natural size. From nature.
- VI. Perfect insect, female. Natural size. From nature.
- VII. Perfect insect, male. Natural size. From nature.
- VIII. Hymenopterous insects, parasitic on larvæ and pupæ. Natural size. From nature.
- VIIIA. Cocoon of hymenopterous insect. Natural size. From nature.



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CHAPTER LXXV.

HUEBNER'S CASE MOTH.

*(Hyalarcta Huebneri, Westw.)*Order: *Lepidoptera*.Family: *Psychidæ*.

These extraordinary insects, the males of which are winged, the females being apterous or wingless, are well represented in Australia, the *Revision of the Family Psychidæ*, by Messrs. Meyrick and Lower, containing descriptions of thirty species. The males, as our plate shows, have transparent wings, with dark bodies and yellowish antennæ, the female being a fleshy grub-looking creature devoid of wings, legs, or any properly developed antennæ.

The females, according to Professor McCoy, "never leave the case or cocoon, but after copulation bring forth an abundance of eggs, and the newly-hatched larvæ lower themselves by a fine string silken thread, and at once commence to each form a portable habitat for themselves, consisting of pieces of tea-tree (*Leptospermum laevigatum*), thin bark, &c. These larval cases (Figs. II. and IIA.) are just opened at the ends, and the larvæ protrude themselves just sufficiently out of the anterior portion of the case to use their legs for locomotion, generally fixing part of the edge of the aperture by fibres of silk temporarily to the twig it is on, so that when alarmed it withdraws completely within the larval case, some of which latter are very strongly fastened together by means of a silky substance, and which remains suspended and quite closed."

The larvæ of these Case Moths are nearly all ravenous feeders, and it is no unusual occurrence to find hundreds of these tiny stick-enclosed grubs, which, unless very carefully looked for, cannot be seen gnawing

away at the leaves of the plants attacked, the singular leafy structures appearing, although constantly moving, not to be inhabited.

These grubs are not particular as to their food plants, and will by reason of their numbers and inconspicuous appearance, quickly make short work of a tea-tree hedge, pine trees, &c., &c. In fact there are very few plants which these grubs will not tackle, and quickly denude of their foliage.

In the coastal districts of Victoria, the damage done is mostly in spring and summer, although the little stick nests may be found hanging on the tree long after their former inhabitants were dead.

As some set off to the great damage which these insects do, they are very subject to the attacks of ichneumons, and other *Hymenopterous* insects, the damage done to the Stick Case Moth being very great.

Some years ago, the Messrs. Hill Bros., so well known for their enthusiasm in entomological matters, exhibited some cocoons of Saunders' Large Case Moth, now named *Oiketicus Elongatus*, which had been torn open by some bird, the elegant little swallow, *Dicæum*, being the suspected culprit. I could never, however, believe that so small a bird could have torn open these strong cases, as I have frequently failed to tear them with my fingers.

Prevention and Remedies.

It has already been stated that the larvæ of these moths are very voracious feeders, so that the simple remedy of spraying their food plants with a deterrent, an infusion of quassia chips, or a weak kerosene emulsion, should be sufficient for the purpose.

If the larvæ should have commenced their attacks, spray the trees with Paris green (paste form is the easiest to use), 1 lb. of Paris green, 4 lbs. best lime, diluted with 150 to 200 gallons of water, according to the nature of plants to be treated. When spraying in the latter case, the plants should be well watched, as two or even more

spraying may be necessary; but in any case the remedy given has over and over again proved absolutely effective.

To those who care for the delightful and useful study of life-histories of insects, the *Psychidæ* offer many advantages, as they can be fed on almost any hard wooded plant, and their metamorphosis will prove highly interesting.

This species is found also in New South Wales, Queensland, and is principally met with in our coastal districts.

PLATE LXIX.

"THE COMMON BEAN BUTTERFLY" (*ZIZERA LABRADUS*,
GODT.)

Fig.

1. French Beans attacked; showing eggs, and larvæ at work. Natural size. From nature.
2. Male Butterfly on wing. Natural size. From nature.
3. Female Butterfly on wing. Natural size. From nature.
4. Larva. Enlarged. From nature.
5. Pupa-cases. Natural size. From nature.
6. Pupa. Slightly enlarged. From nature.
7. Pupa. Natural size. From nature.
8. Egg. Magnified. After Rainbow.
- 8A. Eggs. Natural size. From nature.



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CHAPTER LXXVI.

THE COMMON BEAN BUTTERFLY.

*(Zizera Labradus Godt.)*Order: *Lepidoptera*.Family: *Lycenidæ*.

This common but pretty little butterfly, although the larvæ were well known to feed upon leguminous plants especially, has only recently come into notoriety as an insect destructive alike to the bean and pea grower; and the plate, we think, will show that this pest bids fair, if not promptly checked, to seriously threaten two of the most important vegetable industries of our State.

Those of us who have been accustomed to the bush will have noticed these butterflies flying in large numbers, usually in the spring, when the sun commences to have some power. On the heath grounds of Brighton, Sandringham, and other sandy parts of our coasts, these butterflies are very plentiful; and as there are other species approaching them in general appearance, it has been well named "The Common Blue," it being the most common of the whole family in Victoria.

The male of this species (see plate, Fig. 2) is smaller than the female, and so far as my experience goes, is the more plentiful of the two.

In his excellent work, *A Revision of the Rhopalocera Section of the Australian Lepidoptera*, Mr. F. G. Waterhouse mentions the larvæ of this family as "having sluggish habits; the larvæ are usually night feeders, hiding by day in crevices, or even in ants' nests; in most cases attended by ants; sometimes gregarious; sometimes, though rarely, carnivorous; very often feeding in the buds or seed-pods of leguminous plants."

Messrs. Anderson and Spry lay claim to having found

the eggs on the Swainsona, one of the most useful of flowering plants for the garden.

The eggs of this species are deposited on or near to the plant attacked, and, when hatched, the singular looking grubs soon commence the work of destruction.

Our plate (Fig. 1) shows the manner of attack, and the grubs at work on French beans, peas being served in a much similar manner. There is more than one brood of this butterfly, and according to Messrs. Anderson and Spry, the spring, or September, brood produces much finer specimens than those of the summer and the autumn. The larva of this butterfly is shaped somewhat in the form of a wood-louse, and is a very remarkable creature. It is a singular fact concerning members of this group (*Lycænidæ*) that they have a great attraction for ants, and the late L. de Niceville, of Calcutta, explains that those species attended by the ants have, on the eleventh segment, a gland which gives out a liquid exceedingly prized by the ants; and in consequence they guard and tend the larvæ in much the same way as they do various *Aphidæ* and *Coccidæ*. This attendance by ants is a very singular proceeding, and many times I have been asked whether the ants were killing the grubs, or simply tending them for their own use.

This family is fairly largely represented in Australia, especially in the more tropical parts of it, where certain genera, such as *Danis*, *Miletus*, *Arhopala*, and others, furnish some of the most exquisitely colored of all Australian butterflies. In Victoria, too, there are many representatives of the family, some of the kinds being both rare and of extreme beauty and delicacy.

Prevention and Remedies.

Immediately the bean shows signs of shape, and if the butterfly season be at hand, spray the rows with a preparation of quassia chips; this rendering the plants disagreeable to the insects, which have come for the purpose of egg-laying and rearing an early brood. This

should be carried out at intervals according to the time of the year, the prevalence of the butterflies being the best guide as to when and how to act under the circumstances. Should the grubs, however, have made a commencement on the crop, spray the whole with white hellebore, or a weak spray of 1 lb. of Paris green, 4 lbs. lime, diluted, for this class of vegetable, with 180 to 200 gallons of water; this preparation, on account of its weak strength, being perfectly harmless to either human beings or stock.

When the insect is plentiful, large numbers may be caught with a net, and then destroyed; this to lessen their numbers, and, in the case of the female, to prevent egg-laying.

In places such as above mentioned, the rows of peas and beans should be sown in such a way that there is room left for a spray pump and sledge to work freely between the rows; and, as to the question of it paying to spray these plants, there is no doubt whatever.

As showing the importance of the pea and bean industry in Victoria, it may be mentioned that, according to the Government Statist, no less than 12,012 acres were harvested during the year 1906-7, this area yielding 286,636 bushels.

It may be mentioned that these pests have many natural enemies, especially amongst our insectivorous birds, such as "Fly-catchers," "Wag-tails," certain kinds of "Robins," as well as the justly despised Sparrow, all of which destroy vast numbers of the perfect insects annually.

This insect has a wide range, being found over nearly the whole of Australia, and as Mr. Rainbow, in his excellent new work on *The Lepidoptera of Australia*, remarks:—"Five species of the genus *Zizera* are known to occur in Australia, and of these the 'Common Blue' is the most plentiful and widely distributed."

Again, Mr. Waterhouse remarks:—"This is the commonest, most extended in range, and one of the

most variable of the Australian *Lycænidaæ*; and is one of the very few that are caught in such places as Bourke and Broken Hill."

For the benefit of beginners in the *Lepidopterous* line, I may say that this insect was formerly known as *Lycæna Labradus*, this name being now retained simply as a synonym.

PLATE LXX.

"THE HOLY BUG" (MICTIS PROFANA.)

Fig.

- I. Branch of orange tree with bug. Natural size. From nature.
- II. Branch of orange tree with bug at work. Natural size. From nature.
- III. Insect. Natural size. From nature.
- IV. Larvæ, two stages of growth. Natural size. From nature.
- V. Damaged shoots of orange. Natural size. From nature.



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Plate LXX.

CHAPTER LXXVII.

THE HOLY BUG.

*(Mictis Profana.)*Order: *Hemiptera*.Family: *Coraïdæ*.

This repulsive bug is well known to collectors and orchardists in many parts of Australia, and has long been known here to attack oranges and other citrus fruits, the young shoots being the ones attacked, which causes the wood to have a burned appearance (see plate), thereby destroying the young growth; and in many cases the tree itself, if badly attacked by a number of the insects, dies back to the old wood, causing great disfigurement to the tree and in some cases to the crop as well.

Our plate shows a leaf partly eaten; but this has not been done by the insects in question, which latter do not bite the leaves, but simply puncture them, and thus draw off the sap necessary for the well-being of the tree.

The perfect insect, as shown on our plate, is somewhat sluggish in its habits, large numbers in all stages of development being frequently found on even one small wattle, either *Acacia decurrens* or *A. molissima*. When the weather is hot, these bugs are exceedingly active, the larvæ especially so, the unpleasant odour being too well known to require description here. The larvæ, being soft in the bodies, smell more strongly than the perfect insects.

In his valuable work on Australian insects, Mr. Froggatt calls this species the "Gum-tree Bug," but whether the bug is "holy" or profane, as its specific name would imply, is not definitely known. The cross-like markings on the elytra seem to be the most applicable, although the insects, as Mr. Froggatt remarks, are quite commonly to be found on the young and tender shoots of some of the gum trees (*Eucalypti*), the young saplings of the manner gum (*E. viminalis*) seemingly being a great favorite with them.

Inspector Farrell, of my staff, says: "The young shoots only are attacked; and, from his experience, "the mischief is done by five or six bugs working on the shoot at the one time, the shoot being usually attacked at the part where it has hardened its wood to the top; sucking out the juices, the bugs cause the part affected to wither and die. The tree then throws out other shoots, which are in their turn located and destroyed.

"The young and old usually feed together, and when disturbed, the latter usually fly away, while the former hide among the leaves; but, if further interfered with, they drop to the ground and hide among the debris, &c. They always seem to confine their attention to the more tender part of the tree, as they do not seem to be able to break down the hard tissue of older and more matured wood."

This order of insects has been fairly worked up by specialists, and according to Mr. Froggatt, 1500 species, in 29 families, have already been recorded and described in works which have hitherto been mostly seen only by entomologists.

The eggs of this species are mostly deposited upon the food plants, although, as in the case of these wood or plant bugs, the eggs may be deposited in debris, on old fences, &c.; and in other species, such as *Dindymus*, *Nysius*, *Oxycarenus*, &c., these disgusting insects appear in hundreds of thousands, and work great havoc upon grapes, apricots, peaches, and other soft fruits, and, as they are in such enormous numbers, they are extremely difficult to successfully deal with.

In America the well known "Chinch" bug, as an example, has for years defied all attempts to get rid of it permanently. Commissions have been formed, and the subject dealt with in such a manner as only our American friends can deal with them.

It is unfortunate that, owing to their disgusting odour, few, if any, of our insect-destroying birds will tackle them, and it so happens that a practical natural check in this direction is not, so far, in evidence.

Prevention and Remedies.

Wherever these insects are known to be prevalent, spray the young shoots of citrus fruits with a very weak kerosene emulsion, say one in 30 or 35, this to act as a deterrent, as these bugs do not relish kerosene in any shape or form. In the winter months these insects largely hibernate, so that there would be no occasion to use the above mentioned precautions except with the approach of the warm weather; still a constant watchfulness is, in such cases, always necessary.

In cases where the insects have already commenced operations, large numbers of them may be killed by sharply shaking the trees into an expanded umbrella, or a piece of blanket, spread beneath the trees; but this must be done before the sun gains much power, as, when the weather is hot, the perfect insects will take flight, leaving only the young ones to be dealt with. A bucket of scalding water is about the cheapest and most effectual remedy against those captured.

Spraying with as strong an emulsion as the young growth of the tree will permit is also a good remedy, and will, if persevered with, soon clear the orchard of these troublesome pests.

These bugs have but little fear from the attacks of insect enemies, the large Voconia Spider and a formidable member of the order *Diptera* (*Asilus*) being about the only insects which I have observed to occasionally venture to attack these high-smelling members of the insect world.

In the case of the smaller kinds of plant bugs, a good plan is to mulch the trees with grass, or something of the kind, and, as the tiny insects hibernate at night beneath the mulching, rise before the sun, and, with plenty of help, burn the mulching, insects and all. This, however, must be done before the sun becomes strong, otherwise the insects hitherto concealed will rapidly take flight, only to renew operations when the warmth sets in.

PLATE LXXI.

"THE DARK-SPOTTED SWIFT MOTH" (*PORINA FUSCO-MACULATA*, WALKER.)

Fig.

1. Perfect insect, male. Natural size. From nature.
2. Perfect insect, female. Natural size. From nature.
3. Pupa in vertical burrow, in position for changing into perfect insect. Natural size. From nature.
- 3A. Case of pupa partly above the surface, from which the perfect insect has emerged. Natural size. From nature.
4. Pupa, with fungus, *Cordyceps gunni*. Two-thirds natural size. From nature.
5. *Perethecium*, containing *asci* and *sporidia*. Magnified. From nature.



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Plate LXXI.

CHAPTER LXXVIII.

THE DARK-SPOTTED SWIFT MOTH.

*(Porina fusco-maculata, Walk.)*Order: *Lepidoptera*.Family: *Hepialidæ*

These moths, commonly known to collectors as "Ghost Moths," or "Swifts," are brown, with spots or blotches of a darker color upon their upper wings, the lower wings being of a lighter brown and without the markings.

The common species of *Porina* is well known to most of us as the beast which, especially on hot, moist nights, and indeed even in the winter, bangs against our windows, evidently attracted by the lights within.

The eggs of this moth are deposited in many ways; and, if held in the hand, the female moth will frequently eject the eggs from her body, or in a box when in confinement, as the case may be. The larvæ feed upon grass roots, and, Mr. G. Anderson says, upon the roots of reeds as well, and they are not averse to making a meal of any kind of root crop which they may come across. The larvæ of these moths feed below ground, frequently in loose, damp soil, where they may tunnel more easily.

The perfect moths leave the chrysalid stage during spring and early summer; but, in the dry, hot Murray districts, I have known them to emerge in March, immediately after a thunder-storm being a favorite time of theirs for escaping from the soil.

Many of the *Hepialidæ* are noted for the most remarkable fungus growth (*Cordyceps*), which grows from the head portion, or near to it, of the body of the larvæ of

this moth. It has long been a matter of doubt as to which moth this fungus-infected larvæ belonged. I have now settled this, so far as the simple "stiped" *Cordyceps* is concerned, by having reared the fungus from larvæ when placed in a large case of soil. It is a certainty, however, that the fungus is not confined in its attacks to any one genus or species, as some of the specimens of *Cordyceps* which I have found *in situ* were attached to the larvæ of a much larger moth, probably *Trictena labyrinthica*, the empty pupa cases of which latter moth may be seen commonly near Melbourne, and especially in lightly-timbered forest land, the empty cases projecting above the ground for from one to four inches. When first dug out of the ground, the fungus is of an olive green color, and soft; but, soon after being exposed to the air, the tissues harden, and the whole becomes of a soft and velvety wooden texture. (See plate.)

In the early days of Melbourne, the late Mr. W. Kershaw and myself, in the course of our entomological rambles, have frequently come across dozens of these simple stiped *Cordyceps*, a favorite spot for them being the portion of Studley Park fronting the Yarra Bend Lunatic Asylum; and Mr. Kershaw always held that the larvæ to which these fungi were attached were those of either *Porina* or *Trictena*, or both. I am pleased to be able to clear up part of the mystery at any rate.

Cordyceps taylori is a fine branching species of fungus, and these I have frequently received from Cape Otway and other moist and heavily-timbered districts. I had not room on the plate to figure this fine species, which not infrequently grows to a length of from one foot to eighteen inches.

It is a most interesting question as to how the fungus becomes attached to the caterpillar; the general belief of observers being that spores of the fungus, resting upon the moist bodies of the grubs, take root, and, growing rapidly, cause the grubs to swell, gradually

absorbing the life and substance of the caterpillar attacked, hence the dry and white corky substance mostly present when dried specimens of the fungus are broken in halves. There is no doubt whatever in my mind that the soft nature of the segment near the head and prothorax forms a suitable place for the spores. This subject is a most interesting one, and well worthy of close and further investigation by naturalists living in parts of the world in which these singular vegetable-caterpillars occur.

To the grazier the presence of these large underground larvæ is not assuring, as quantities of grass must, by reason of losing its roots, be consumed without, to him, any apparent cause.

Prevention and Remedies.

Fortunately for the grazier, not ten per cent. of the moths, although the female lays a large number of eggs, ever come to perfection, birds especially, such as the *Podargus*, and also bats, are ever on the alert for them, and, as such useful helps, should be rigorously protected. The rightly-abused sparrow, too, will not hesitate to tackle an isolated specimen of this large moth, a few occasionally making their appearance during the day time, but these solitary individuals seldom escape the attention of either birds or ants, or both, the ants biting the wings off the crippled victims, carrying the fragments to the formicarium in sections. When this can be done with safety, fires lighted here and there will attract large numbers of these moths; and it should be borne in mind that every female (which is the larger of the two) killed, is one less for egg-laying.

I have included this moth in the destructive insects list, as the caterpillars, being large and living a long time in the ground, must do a lot of damage, which latter has possibly been improperly attributed to grubs which are altogether distinct from this species.

PLATE LXXII.

“GREEN HANGING-MOTH OF THE APPLE” (*CHARAGIA*
LIGNIVORA, LEWIN.)

Fig.

- I. Branch of apple tree. From nature.
- IA. Larva at work. From nature.
- II. Pupa of moth. From nature.
- III. Female moth. From nature.
- IV. Male moth. From nature.
- V. Moth at rest. From nature.



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CHAPTER LXXIX.

GREEN HANGING MOTH OF THE APPLE.

(*Charagia lignivora*, Lewin).

Order: *Lepidoptera*.

Family: *Hepialidæ*.

The *Hepialidæ* family of *Lepidoptera* is, to the entomologist at any rate, very interesting, furnishing as it does some of the most beautiful as well as the largest and most destructive of all known moths.

In Victoria this family is rather poorly represented; but in New South Wales and Queensland are found such splendid things as *Leto Staceyi*, *Charagia mirabilis*, *C. Ramsayi*, and others, the first-named moth being from nine to eleven inches across the wings; and the larvæ of all these insects are terribly destructive to timber trees.

In Victoria, however, we have a few fine and handsome species, the subject of the present chapter being, as the plate will show, a beautiful moth. The upper wings in the male are a soft pea-green color, with silvery white markings, the lower wings being a very pale green.

The female, which is somewhat larger in size than the male, has the upper wings of a darker shade, with purplish bands or markings across them, the lower wings being of an orange-pink color, and the head a dark brown; and one not conversant with entomology might think it a different species.

It is a singular fact, while the sexes of most of the species of *Charagia* so greatly differ in general appearance, there are other species, as *C. daphnandræ*, in which the sexes are not easily distinguishable, excepting in size, to the ordinary observer.

The larva, or caterpillar, of this moth is of a pale pink, frequently changing into a yellow or a pinkish-yellow, with head of a dark brown color, and which is furnished with strong jaws or mandibles.

The pupa is of a yellowish-white with a brown head, the figures in our plate showing the moth in a resting position, the whole having been drawn from nature.

Hitherto this moth had confined itself to native trees, such as *Melaleuca*, *Leptospermum*, young *Eucalypti*, *Cassinia*, &c.; but of late it has made its appearance in the well-known orchard of Mr. Grant, of Pakenham, Victoria, at which place it bade fair to be terribly destructive to apple-trees especially.

But, as was to be expected from growers of Mr. Grant's type, the matter was at once reported to the entomologist, the result being that the pest was attacked with such vigour that not a trace of it remained in the orchards.

Upon examination it was found that the female moth deposited her eggs upon the bark of the trees, and, when hatched out, the young larvæ crawl into crevices or loose bark, and at once commence to eat their way into the tree attacked.

In many respects the larva of this moth resembles in its workings the grubs of the well-known "Cherry-borer," a plate of which is given in a former part of this work. As the larvæ increase in size, the damage done is proportionately greater, until at last the tree is so tunneled that the affected parts at once commence to die off.

The presence of these grubs, when in a tree, is easily noticeable by a swelling with a sort of sawdust covering (see plate), this being simply an accumulation of a sawdust-like material enclosed in a delicate web, which latter is, I suspect, intended to form some protection to the grub inside the tree.

When the perfect moths emerge from the pupæ they at once commence to crawl upwards, and cling to the tree, shrub, or whatever they can lay hold of, and will

remain in the hanging position until such times as the wings and other parts have become sufficiently hardened by exposure to enable the insects to take flight.

This moth is rarely met with when on the wing, and is much more difficult to rear artificially than many people suppose.

In the bush it is no uncommon occurrence to see numerous plants of Aster, Acacia, &c., badly affected by the larvæ of this pest, the bulged portion of the stem of the plant being sufficient indication of the damage going on within.

Prevention and Remedies.

Remove, where possible, all old and badly infested wattles, gums, and other trees growing in the vicinity of the orchard. Give the tree when dormant a spraying or two with either kerosene, tar, water, red oil or any other solution, which would render the flavor of the surface of the bark unpalatable to the female moth to rest upon for the purpose of egg-depositing. In doing so, spray the stem and the thicker branches of the tree.

After pruning, paint the stumps with tar and grease; remove all loose bark, and daub with a whitewash brush any of the above solutions into the crevices and notches of the trees. For the purpose of preventing the larva from descending from the tree and ascending another, a good plan would be to paint the tree with kerosene and grease, or, if the latter course be thought too severe, try the zinc inverted bands on the trees.

When the presence of the borer is first suspected, first clear away the sawdust-like material before mentioned, the removal of which will indicate the direction taken by the grub; but, as the holes are frequently made in a horizontal position, the ordinary methods of spraying should be somewhat departed from. If the spray pump and nozzle be used, project, with as much force as possible, the liquid into the hole, being guided by the direction taken by the grub.

In gardens where there are but few trees, small pieces of stick dipped into carbolic acid, three parts of tar to one of acid, could be driven into the holes, which will in most cases cause the grub to shrivel up at once and die. In large places this method would be perhaps too tedious; still the services of children might be utilized for this purpose, as the little sticks could be prepared by night around the family fire, and any active boy or girl could prepare a lot of these sticks in one of our long winter evenings. These sticks can be easily carried in a billy-can strapped in front of the operator.

As the grubs of this moth, if not destroyed, remain in the wood for a long time (how long has not to my knowledge been definitely ascertained), it will be the more necessary that the pest should be tackled at once, and without loss of time.

The use of a slush lamp might also be tried for attracting the moths, when they could be captured and destroyed.

The forcing of steam vapor into the holes made by these and other boring insects would, I feel certain, be of great benefit, as witness the saving of the fine elm trees in the saddling paddock of the Flemington Racecourse; which treatment was recommended by the writer, and, to the joy of members of the V.R.C. and the public, was eminently successful.

Old and abandoned orchards are fertile sources of infection, and should be carefully watched by growers and everyone interested in fruit-growing as a pleasureable, healthy, and profitable industry.

Before closing this chapter, it may be mentioned that the question is frequently asked—How it is that insects which do so much damage are so seldom seen by collectors? The reason for this is well known to entomologists who have worked in the Australian bush, and is—That all insects are more or less soft when just emerged from the pupæ, hence it happens that at this helpless stage they fall an easy prey to ants especially,

who, taking advantage of their helplessness, seize the opportunity to dismember, one by one, each and every one of the stragglers who may be so unfortunate as to fall into their clutches. Again, there are many beetles which appear rare, that are, in fact, quite common; but, as they ascend the branches immediately after emerging from the pupæ, and fly only by dusk and after dark, are thus seldom captured either on the wing or at rest, although the very same insects may be easily removed from the wood where they are common.

One word as to the little black ant so common in all parts of the State. This little beast is cruel in the extreme, and the manner in which it can dispose of a large beetle is something marvellous. The writer has seen specimens of a large black *Carenid* beetle (*Scaphites rotundipennis*), an insect of about two inches in length, hard, and armed with powerful jaws, which had rolled over on its back in the sand, and was unable to right itself. Now is the time for the little black ants, who, in rapidly increasing numbers, commence operations by biting off each tarsus, or foot, separately; they then tackle the antennæ, which are quickly bitten off in the same manner; and the unfortunate captive, who is gradually becoming more helpless, is then assailed by the ants, who sever the cartilaginous part by which the head and the thorax are joined to the body; and, this being done, the little wretches eat their way into first the thorax, and, having finished clearing this out, tackle the interior of the body portion of the beetle, the poor beetle being still alive. The little black ant is a nuisance, but the quantity of insects which a party of these ants get through is something astonishing; and one would never think, when watching these tiny creatures at work in the innocent recreation of "milking" aphids, or plant lice, that they were such merciless destroyers of insect life.

PLATE LXXIII.

"ELEPHANT BEETLE OF THE ORANGE" (*ORTHORRHINUS
CYLINDRIROSTRIS*, FABR.)

Fig.

- I. Section of orange tree, showing damage done by larvæ.
From nature.
- II. Perfect insect, dorsal view. Natural size. From nature.
- IIA. Perfect insect, side view. Natural size. From nature.
- III. Larva. Natural size. From nature.
- IV. Foreleg of male. From nature.
- V. Foreleg of female. From nature.
- VI. Head of perfect insect. Magnified x 2. From nature.
- VII. Antennæ. Magnified x 3. From nature.



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CHAPTER LXXX.

THE ELEPHANT BEETLE OF THE ORANGE.

(*Orthorrhinus cylindrirostris*, Fabr.)

Order: *Coleoptera*.

Belonging to the great family of the *Curculionidæ*, or "Weevils," this destructive pest has only recently made its appearance here as a pest of the fruit-grower, although in New South Wales and in Queensland it has been long known as one of the most noxious of the indigenous insects.

Mr. Froggatt, whom I quote, gives some interesting facts regarding the habits of this beetle, and which greatly adds to the disrepute of the insect in question. Mr. Froggatt says: "In their native state they show a marked preference for freshly-fallen timber when the bark is just beginning to wither, and I have often found them on a freshly-cut rail or log before it has been barked; if there are any about the neighbourhood, they seem to find them very quickly. Some specimens kept in a building-case gnawed most of the bark off a branch placed in with them; and upon the 8th of January one was observed to be clasping the twig with the middle and hind legs, with the long forelegs and head hanging downwards, moving the tip of the abdomen, which was closely pressed against the bark. When examined next day, a small circular pinhole about half a line in depth was found, at the bottom of which was a single yellow rounded egg."

In our plate, taken from nature, we were only able to show the larvæ at work, not having seen the perfect insects working in the same way as that indicated by Mr. Froggatt. One singular fact, as noted by Mr. Froggatt, is that, in the New South Wales orchards, this beetle suddenly disappeared, only to reappear again in ten years' time. I will allude to this matter later on.

The late Mr. S. Olliff, then Entomologist at the Australian Museum, Sydney, remarks: "We have no knowledge of the way in which the parent beetle deposits its egg; but, from what we know of the habits of other weevils, it is highly probable that the insect bores a hole with its long slender rostrum in the bark of the tree, and afterwards deposits its egg within it. When the egg hatches, the young larva bores its way into the wood. The exact period between the laying of each egg has not been observed as far as I am aware, nor is it known for certain how long a time elapses before the insect attains maturity, although we have good reason for assuming that the period is a somewhat lengthy one, possibly extending to a year or thereabouts."

The perfect insects are met with plentifully throughout the spring and summer, and it would appear that the larvæ do not confine their work of destruction to this season, but feed busily all the autumn and winter. It is only after the emergency of the perfect insects that the timber shows any obvious signs of the destruction going on within, when they make their way out of the stems, leaving behind them holes measuring about a quarter of an inch in circumference.

If a section of an affected limb is made previous to the emergency of the perfect beetles, smooth circular tunnels will be found traversing it in various directions; and at the extremities of these tunnels, at the point furthest removed from the original opening or orifice, the larvæ or pupæ will be found. The tunnels are lined with triturated wood.

As long ago as 1862 the late Mr. A. W. Scott traced the transformation of this species, and the notes made at the time by that observant entomologist contain some interesting observations, which, through the kindness of my friend Mr. E. Ford, I am able to quote. Mr. Scott says:—"The orange-tree, it is well known, furnishes food for many insects, both externally and internally. The smaller fibrous roots supply food to the larvæ of *Cystosoma Saundersi*, an interesting insect of the *Hymenopterous* order; the leaves support the larvæ of our largest and most beautiful *diurnal lepidopteras*, as well as various *Aphides* and *Coccidæ*; and the trunk is used by many *Coleoptera* as their habitation. The latter have lately increased to an alarming extent, an increase which may be probably attributed to a succession of wet seasons and inefficient drainage, resulting in the partial decay of the roots and butt of the tree, and inducing a languid circulation of the sap, and general sickliness, which predisposes it to receive the attacks of this obnoxious insect, which belongs to a family but too well known and dreaded by agriculturalists, on account of the prodigious power of multiplication possessed by some of its species. I allude to the *Rhynchophora* of Latreille, or *Curculionidæ* of other authors, a familiar example of which will at once recur to you in the *Calandra granaria*, or common weevil, a single pair of which, according to the calculations of the celebrated De Geer, will produce (among themselves and their descendents) in the course of a season 23,600 individuals."

Mr. Scott says:—"Like all the pupæ of the weevils, the rostrum or snout is bent beneath the head, and closely pressed against the head and thorax. It remains in this stage for about eighteen days, when the adult beetle, removing the entrance to the tunnel in which it has lived, by means of its powerful mandibles or jaws, crawls forth, leaving behind it a circular hole of considerable size and regular in form. During October and November (in New South Wales), particularly towards

the evening, when these pests emerge in immense numbers, trees which, on the previous day, were perfectly sound will be found to present a surface filled with holes, and on examination the cause of all this injury, the perfect elephant beetles, will be observed clinging singly and in pairs to the bark in the immediate vicinity."

We have here an insect of a very bad type, and although by no means common here, it requires well watching, so as to prevent it increasing as it appears to have done in New South Wales and Queensland. This beetle has also been found destroying the elms and other introduced trees in the Melbourne Botanic Gardens, and also the tamarisk belts on Altona Bay, Victoria, no less than fifteen perfect insects having been taken by my assistant, Mr. C. French, Junr., out of one tree; and in some instances the larvæ must remain in the timber for several years before changing into the perfect insect.

Prevention and Remedies.

An occasional spraying with either quassia chips, kerosene emulsion, or white hellebore, may prevent the beetles from resting or feeding on the tree. Should the beetles have attacked the tree (if the tree be not too large), jarring by means of a wooden mallet will dislodge large numbers, that the sheet, spread under the tree for the purpose, would catch, when the beetles could be killed by means of scalding water. These beetles are very tenacious of life, so the water must be quite on the boil to be effective in killing the beetles.

Mr. Acres informed Mr. Olliff that, some time since, he had succeeded in destroying large numbers of the beetles in the larval stage, by inserting a piece of fine wire into the puncture forming the entrance to the tunnels (and thus killing the grubs), and in this way he believes several orange-trees were entirely freed from the pest.

In one of Mr. Froggatt's articles on this pest, he speaks of nursery stocks having been attacked; and one

orchardist informed him that he had lost over a thousand stocks the year before, and that the beetles showed a marked preference for seedling orange and lemon stocks; he also said that he could tell any young tree that contained the larvæ from the color of its bark; and that by pulling up and burning all infested stocks, and spraying the others with a liberal dose of Paris green, he had cleared them out of his nursery.

Mr. Froggatt thinks, "that as the beetles always lay their eggs in the bark on the trunk of the tree, within a foot or so of the ground, it would be an advantage to keep the earth up round the trunks of the trees during the time when the beetles are egg-laying, from October to December, and wash the uncovered portion above with carbolic soap, or some other offensive smelling substance, that at the same time would not injure the bark of the trees."

In treating oranges and lemons in the hot dry climate of Victorian summer, one would have to be very careful, as here oranges, and lemons too, are singular trees to deal with, and any "banking-up" would hardly commend itself to Victorian growers of citrus fruits generally.

A smaller species of this genus (*O. klugii*), which is figured in Vol. III of this book, would appear to be becoming rarer in Victoria, as we have not captured a specimen for a long time. Let us hope that the large one, too, will become scarce.

PLATE LXXIV.

“ORANGE AND FIG TREE BORER” (*BOSTRYCHOPSIS*
JESUITA, FABR.)

Fig.

1. Apple branch, showing damage done by larva. From nature.
2. Larva. Natural size. From nature.
3. Perfect insects, dorsal and side views. From nature.
4. Head of perfect insect. Magnified. From nature.



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CHAPTER LXXXI.

THE ORANGE AND FIG TREE BORER.

*(Bostrychopsis jesuita, Fabr.)*Order: *Coleoptera*.Family: *Bostrychidæ*.

The subject of our plate is a hard black beetle, the size of the insects shown in the drawing. The first time I heard of this beetle doing damage to fruit trees, the news came from Mildura, where the beast had begun to play havoc with some of the orange trees growing in the settlement. Since this time, however, the beetle has started its destructive work much nearer home, although there is no doubt about its being plentiful in the native trees about Mildura and other of the hotter portions of the State—situations which one may with safety term its natural habitat. Later on, Mr. A. F. Thiele, the well-known orchardist and citrus grower of Doncaster, Victoria, complained of some borer beetle having commenced upon his orange trees; and, as Mr. Thiele has a great leaning towards economic entomology, he very soon set to work to ascertain the cause of the trouble. It was found that the larva of some beetle had bored into the wood of the orange trees, and then commenced the tunnelling work, as shown on our plate. This pest will also attack lemons, figs, and apples; and, on one occasion, a specimen of this beetle in a single night bored through a stout cedar table, through a carpet, and partly through a strong floor, where I discovered the beetle still boring when opening the office in the morning. It may be explained that the specimen had been placed under a tumbler for close observation, hence the beetle's haste to regain its freedom.

This is an insect which will have to be closely watched, as, unlike the smaller *Bostrychidæ*, its size and strength

enable it to do irreparable damage in a short space of time, as a tree badly attacked by this pest speedily becomes past all hopes of recovery.

Beetles belonging to this family are among the worst of tree pests, the genus *Rhizopertha* being responsible for a vast amount of damage, and of which that caused by our tiny apple-tree borer is a good example. An allied group, the *Scolytidæ*, are fearfully destructive to many of our finest trees, and especially to elms; but in Victoria it would appear, from what I have observed, that the two groups before-mentioned are not nearly so destructive as are the *Longicorn* beetles, nearly all of which are, while in the larval stage, wood-feeders.

In attacking the orange and other trees, the female beetle deposits her eggs just below the surface of the bark. When the eggs are hatched, the young larvæ soon commence to eat their way into the wood, and, when fairly inside, tunnel into the tree mostly longitudinally, as shown on our plate.

This, to Victorian growers, is quite a new pest, but in Queensland and some of the hotter parts of New South Wales it is a fairly common insect.

Mr. Froggatt, in one of his many able papers on various Australian insects, calls this pest the "Augur Beetle," and if we are to judge the beetle on its merits and past performances, the name is a most appropriate one.

Hitherto it appears to have been an open question as to whether this beetle attacks growing trees, or only those which are either dying or dead. I can vouch for their attacking living trees; and it is the "dying-off" appearance of infested branches which indicates the presence of the borer within the trees.

Prevention and Remedies.

As prevention is better than cure, a sharp lookout should be kept for the perfect insects of this formidable pest. Smearing the trees with tar-impregnated grease,

or spraying occasionally with some deterrent—as kerosene emulsion, &c.—may have a good effect in preventing the female from commencing its boring operations. Should, however, the trouble have commenced, as soon as the danger is observed, the tree, or such parts of it as are badly affected, should be at once grubbed out and burned, special care being taken that none of the larvæ or perfect insects escape. The next best thing to be done—supposing the trees to be only slightly affected—is to apply, by means of a good spray pump, a strong solution of kerosene emulsion, say one in eight or ten; but, as the holes made by the borer are placed horizontally, the liquid must be used with considerable force, so that it may be driven horizontally into the holes, when not only will the grubs and beetles be destroyed, but the bark will be rendered—for a time at least—obnoxious to this and other insects, and would in all probability be the means of preventing other insects from depositing their eggs, or otherwise working on or in the bark of the tree. Remove by scraping all loose bark, as the less shelter for the beetles, the less danger there will be of attack, and the easier it will be to detect any inroads made by borers or other noxious insects.

As this is another instance of an indigenous insect adapting itself to imported fruit trees, it behoves fruit growers to pay special attention to the immediate destruction of all badly-infested native timbers, as the latter may prove to be a practically unlimited source of trouble to those whose orchards happen to be in the vicinity of forests or timbered country in general.

Stopping the holes with wire dipped in either carbolic acid or bisulphide of carbon has been suggested; and if the wire is well stuck into the holes, and the bottom of the hole probed as far as possible, it is a good plan, as I have frequently proved.

The application of sulphur, bisulphide of carbon, and other fumes, by means of steam power, providing that a machine for generating and distributing the

above materials in vapour form can be supplied to the public at a reasonable price, is to be highly recommended, as the forcing of the steam would penetrate so far into the workings of the borers as to either make their position altogether untenable, or to entirely destroy them, grubs and all, to say nothing of its usefulness in distributing the Bordeaux mixture and other fungus-destroying compounds to the resting spores of the fungi, as *Fusicladium* (or scab); *Capnodium* (or smut fungus); *Roestelia* (or scab); mildew; oidium; curl in peach; shot-hole in apricots, cherries, and plums; black spot in grapes; and other pests of the orchardist and vigneron.

PLATE LXXV.

“THE STEEL-BLUE SHE-OAK BORER” (STIGMODERA
VERTEBRALIS, DONOVAN.)

Fig.

1. Branch of she-oak (*Casuarina quadrivalvis*), showing larva at work. Natural size. From nature.
2. Perfect insect. Natural size. From nature.
3. Parasites of grub. Natural size. From nature.
4. Pupa of parasite enclosed. Natural size. From nature.
5. Wing of parasite. Natural size. From nature.



C. C. Brittlebank, Del.

C. French, Dixit.

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Plate LXXV.

CHAPTER LXXXII.

THE STEEL-BLUE SHE-OAK BORER.

(*Stigmodera vertebralis*, Donovan).

Order: *Coleoptera*.

Family: *Buprestidæ*.

This serious enemy of our so-called She-oak trees (*Casuarina*), is fairly common in many parts of Victoria and New South Wales, although the beetles themselves are not frequently seen, as they are probably destroyed by ants. Spiders and birds attack them, especially after they emerge from the wood, when the parts are soft and not sufficiently hardened.

In the perfect state, the beetles may frequently be found on flowering plants in hot weather; and in former years they have been much more plentiful than they now appear to be. The beetle itself is frequently found dead under gum-trees; and, there is no doubt that this pest does not confine its attacks to *Casuarina*, but attacks the *Eucalyptus* as well.

The larva (see plate) is supposed to remain in the wood for a considerable time, and while there, until the pupal stage is reached, is eating all the time.

The splendid family of the *Buprestidæ* are, when in the larval stage, all or nearly all wood-feeders; and, as has been stated in another chapter, do immense damage to some forests.

The wasp-like insects shown in Fig. 3 are parasitic on the larvæ of this beetle, and may often be seen crawling over the bark, and probing any holes or crevices with their long wiry ovipositors.

In many cases, not only in the large group of which we are now writing, the dead or partly dead timber only is attacked, still the greater proportion attack the tree when growing; and, when they bore into the centre,

the tree becomes sickly and dies. (Our plate will show to what extent these larvæ will injure the limb of a tree.) Our forests tell a pitiable tale of the damage done by these and other boring insects.

The color of this beetle is mostly steel-blue, legs and all; the male being much smaller than the female.

Prevention and Remedies.

In small holdings, and with valuable trees planted artificially, these borers can be kept off by means of a spraying with kerosene, &c., as a deterrent; but, when trees in a forest are attacked, the only way is to cut them out, if beyond redemption, and burn them on the spot or as near to it as possible.

In the European forests, where labor is cheap, as also in India, great attention is paid to forest insects, and no expense is spared in combating the evil. In Victoria we could hardly afford extensive measures, and are thankful if we can but protect our orchards.

So far this beetle has never been known to attack introduced fruit-trees; and I do not think there is any likelihood of its so doing.

PLATE LXXVI.

(TRYPHOCHARIA MASTERSI, PASCOE.)

Fig

- I. Fragment of wood, bored by larvæ. From nature.
- IA. Eggs. Natural size. From nature.
- II. Larva. Natural size. From nature.
- III. Pupa. Natural size. From nature.
- IV. Perfect insect, female. Natural size. From nature.
- V. Perfect insect, male. Natural size. From nature.



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CHAPTER LXXXIII.

MASTERS' GUM BORER.

(*Tryphocharia mastersi*, Pascoe.)

Order: *Coleoptera*.

This fine, though very destructive, *Longicorn* beetle is chiefly responsible for a great portion of the damage done to gum-trees around Melbourne, and throughout the greater portion of the State. The credit of first determining the life-history of this beetle is due to the field investigations of Mr. Giles before mentioned. The larvæ of this beetle do considerable damage to the gum (*Eucalyptus amygdalina*) saplings; the larvæ work round and round the trunk of the trees, the top part falling to the ground into which the larvæ have burrowed; the trees have the appearance of having been blown down, as the cut boughs are very rough, and not like the usual smooth cut boughs of the other *Longicorns*. Most of the large blue-gums (*E. globulus*) in our Botanic Gardens and Domain have been destroyed by the larvæ of these and other beetles; and when the trees were being split up for fire-wood many of the perfect beetles of this kind were found, the month of September being the time of their first appearance, the usual time being January and February.

It has been noticed that many of the larvæ of this beetle are destroyed by some fungus growth, which also kills off the perfect beetles while in the wood, and before emergency. The eggs are yellowish, and when first deposited are covered with a sticky substance. We have noticed that thirty-five eggs have been laid by the one female when in confinement, and that the perfect beetles have lived for three weeks without food.

Our plate shows the beetle, both sexes, as also the wood bored and tunnelled by the larvæ. The larvæ of the *longicorn*, or long-horned beetles, remain in the wood for a great length of time, sometimes feeding in the timber for several years, so that it is small wonder that the damage done is so great. Fortunately, however, these borers leave well-marked indications of their presence in the tree, the sawdust-like material, when falling from an infested tree, always helping to draw attention to the mischief going on within. The larvæ are "fat" yellowish grubs, and are eagerly sought after by the black cockatoos especially, as these fine birds, by means of their powerful mandibles, are able to tear off not only the bark, but also large splinters of the wood of the tree; the black cockatoo being one of the most useful of Victorian grub-eating birds.

In a former chapter I have stated that most of the *longicorn* beetles, upon emergency from the pupa, ascend the tree; and although *T. mastersi* is so great a scourge to many of our forest trees, it is singular that so few specimens are to be captured in the ordinary way, although occasionally a specimen or two may be taken from under the bark of the trees, both in the saplings and in the adult stage. Another fine species, *T. hamata*, is now comparatively rare in Victoria, and, for the sake of some of the native trees, we trust it will remain so.

So far, but few of the native *longicorn* beetles have left their natural food for that of the orchards, although numbers of our indigenous beetles have done so. We must, however, be on the alert, as the larvæ of beetles of the type above described, would, when they attacked them, make short work of our fruit-trees.

Prevention and Remedies.

Prevention, in the case of forests, is impossible or next to it; but in the early sapling stages some spraying with kerosene would certainly act as a deterrent. All limbs showing signs of infestation should be cut off and

burned, and the beetles, especially by lantern-light, carefully looked for. This beetle was named by the well-known entomologist, the late Mr. Pascoe, in honor of Mr. Masters, the present curator and custodian of the celebrated Macleay collection of insects in the University of Sydney, New South Wales; Mr. Masters being one of the pioneer entomologists of early Victoria.

PLATE LXXVII.

"THE DARK-GREEN GRASS CATERPILLAR" (ONCOPTERA
INTRICATA).

Fig.

- I. Plant of grass, showing root, and caterpillar in ground.
Reduced. From nature.
- II. Shaggy covering to cocoon. From nature.
- III. Pupa, near to changing. Natural size. From nature.
- IV. Male moth. Natural size. From nature.
- V. Female moth. Natural size. From nature.
- VI. Larva, badly affected with parasitic fungus. Natural
size. From nature.
- VIA. Larva, badly affected with parasitic fungus. Natural
size. From nature.



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G. French, Drexel.

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Plate LXXVII.

CHAPTER LXXXIV.

THE DARK-GREEN GRASS CATERPILLAR.

(Oncoptera intricata, Walker.)

The larva of this moth is, without a doubt, the most destructive of all grass-eating grubs known to myself. The female moth (see Fig. V) is of a light brown color, mottled with darker markings on the upper wings; the male (see Fig. IV) being much lighter in color than the female. The larva, or grub, of this moth is of a dirty sap-green color; is an active beast, making spasmodic jerks when handled.

The eggs, which I have not seen, are described by Mr. Lea, Government Entomologist of Tasmania, as follows:—"The eggs when first laid, and when in the body of the mother, are of a creamy yellow, and briefly elliptic in shape. The shell, under an ordinary microscope, appears to be perfectly smooth. Some time after being laid, they change to a deep glossy black, and slightly diminish in size. So far as I have observed personally, the eggs are laid when the moths are on the ground; they are laid closely together, in any position where the moths can obtain shelter; the eggs are in no way joined together.

The female seems to deposit her centre load in but one or two places; after the eggs are laid she dies, but her abdomen remains more or less inflated. The abdomen of the female seems to be entirely filled by the eggs, and when full extends beyond the wings for some distance. In the male it either just passes or scarcely reaches the tips."

In Tasmania the Rev. Mr Thompson states, "that upon examination, one female was found to contain 332 eggs; and the females lay from 500 to 700 eggs each;

probably the number of eggs laid varies according to the amount of food consumed by the larva."

The pupa (see Fig. III.) is of a light brown color, with the skin covering the head parts of a darker brown. It is well-known that these grubs construct tunnels in the ground, and as a rule very close to the surface.

In the Journal of the Council of Agriculture, Tasmania, Mr. Box, as quoted by Mr. Lea, states:—"In the month of June I found them, the grubs, just under the surface of the ground, about half an inch long. In July and August they had increased in size to an inch and a half, burying themselves in the ground, and covering their holes with a web."

It is, Mr. Lea says, extremely probable that the grubs wander considerably, and that no other tunnel is constructed. From the time the grubs are three-fourths fed till their final change, however, I am convinced that each grub inhabits only one tunnel. This opinion is held for several reasons, which may be stated as follows:—The tunnel is often of great length, and constructed in very hard ground; the grubs feed solely at night time, and never far from the mouth of their tunnel; no grit is to be found in their intestines; when badly infested land is ploughed out, the land in the vicinity does not become more infected than previously; the prevalence of cannibalism, and the fact that patches are eaten bare and constantly kept bare.

The tunnels are seldom wider than a lead-pencil, and vary in length according to the hardness of the ground. In hard ground, I have seen the tunnels from three to six inches long, usually about four inches; in soft ground they are seldom less than nine inches in length, and frequently are more than a foot. Where food is abundant the tunnels are heavily lined with silk; but, where the food is poor, the silk is much less in evidence. The tunnel is usually at an angle for the first half-inch; but after that generally goes straight down, or with a slight curve. Mr. Thompson states

that "in damp, low-lying ground, the holes will frequently be found to have a small tunnel, proceeding at right angles from the bottom of the shaft." These I have not seen, the tunnels examined having been in dry ground.

From the mouth of the tunnel, a sort of covered way is constructed above ground; this is roofed with bits of dry grass and excrement cemented together with silk. It seldom stands more than six inches from the tunnel, and the grubs seldom go more than six inches from its exit. On being alarmed, although they proceed backwards, they never fail to reach its entrance. Heavy rain destroys these outer covered ways, so that the entrances to the tunnels are exposed. If the grubs are not fully fed, the damage is repaired at night time; but, if they are fully fed or have changed to pupæ, the holes are left exposed.

With regard to the larvæ of this moth eating the roots of the grass as well as the tops, Mr. Lea combats my statement, and, taking everything into consideration, I feel sure he is right, as I find the roots eaten only when the grubs are in captivity, or, if of a paler color than the typical grub itself, namely, with a new skin or from the moult. It has also been stated by Mr. Lea that he has never yet found a parasite on the larvæ of this moth; but I have found one (see Fig. VI.) on a partly shrivelled grub of this moth, and another kind of fungus was also found (see Fig. VIA.) on a grub found in the vicinity and in the same patch of soil, so I feel convinced that these dark green grubs are by no means immune from the attacks of either fungus or diseases of a bacterial growth.

In alluding to diseases among larvæ, I may mention a case which occurred two years ago in the Bacchus Marsh district of Victoria, which went to show that some diseases, whether they be of bacterial origin or otherwise, are wonderfully fatal to caterpillars. It was found that large numbers of small grubs were eating off the grass,

and bade fair to ruin many of the pastures in that district. I was anxious to secure living specimens for experimental purposes; but, in a few days from the time of receiving the information, was unable to secure a single living specimen, a fatal disease having suddenly made itself known, and the grubs by the millions were fastened on to the grass, dead, and in a state of putrefaction, so that a living specimen of the destroyer of pastures was not obtainable.

Prevention and Remedies.

We now come to the most important part of the matter, and Mr. Lea may well say—"The more I see of this pest, the more difficult appears to be any way of destroying it." Many plans have been tried and suggested, the best results having been obtained by spraying specially planted or sown patches of cocksfoot grass with paris green, a remedy which is both cheap and effective. In spraying with the arsenical preparations, however, care must be taken to keep stock off the patches for several weeks, and the experiment, if I may so term it, is well worth the trouble and the time devoted to it. The plan of travelling sheep to and fro over infected areas is no doubt a good one, as an injury to these grubs, however slight, is usually fatal to them.

Where the grubs can be brought to the surface through the use of gypsum, sulphate of ammonia, or similar agencies, a light brush harrow passed rapidly over the land will destroy enormous numbers, and this plan can be highly recommended, and full particulars as to how to use the above materials will be found in another chapter. When at all possible, flooding the land has given excellent results, as this brings the grubs to the surface, where birds, ants, and other animals soon speedily make short work of them. Catching the moths by means of nets, etc., is to be commended, as, although males are the more numerous, the more of either sex killed the better.

Mr. Lea speaks of pigs having been employed in the work of keeping down this pest, and no doubt, if the pig were a discriminating animal, it might do a lot of good in this direction, but it is not to be trusted in its choice of food. Where caterpillars especially are concerned, the insect-destroying birds are valuable helps to the farmer and grazier, and although the best of our birds are day-feeders, and these would probably be of very little use against the pest in question, it behoves everyone of us to do at least something towards the protection of these valuable birds. As showing what the Straw-necked Ibis can, and will do, Mr. Le Souef may be quoted when he says, "The parents feed the young birds by placing partly digested food in their mouths, such as grasshoppers, caterpillars, fresh-water snails, etc., and, if the young birds are handled, they occasionally ejected the food from their stomachs. The contents of an adult bird, by actual counting, were 2,410 young grasshoppers, 5 fresh-water snails, several caterpillars, and some coarse gravel. This is to be multiplied by 200,000 (this being an estimate of the number of these birds seen in one locality by Mr. Le Souef and Dr. C. Ryan), thus bringing the grand total up to 482,000,000 odd grasshoppers, etc. The hand of every farmer, grazier, and fruit-grower should be against the "pot-shotter," the indiscriminate egg and nest robber, and the small boy with the destructive but harmless-looking pea rifle, should be wiped out of existence.

Before closing this chapter, I should like to point out the probable efficacy of daubing the grass in badly affected spots with a thin paste composed of bran, arsenic, and treacle, and the grasshopper fungus—successfully used by us here—might also be given a fair trial.

The following is a report on the subject by Inspector E. Meeking, of this Department :—

MORDIALLOC, 1ST FEB., 1908.

"On the 4th July last, I proceeded to Leongatha to investigate the ravages caused by the grass caterpillars (*Oncoptera intricata*) commonly known throughout South Gippsland as "Take-all." I selected Mr. Thomas Crichton's property on which to carry out experiments, as having suffered more from the pest than any other in the district. Ploughing or scarifying the land as deeply as possible so as to expose the caterpillars, which live in holes of from 12 to 18 inches deep, to insectivorous birds, would have been the simplest method of eradicating the pest; but the rough nature of the affected land, covered as it was with stumps and logs, prevented this. I determined, therefore, to try top-dressing small areas with various chemicals, which, while being fatal to insect life, would also act as a manure for the soil. I marked off five plots of a square chain each and top-dressed them respectively, at the rate of 56 lbs. per acre, with the following chemicals:—Chloride of Potash, Sulphate of Ammonia, Sulphate of Iron, Gypsum, and Quicklime.

No result was apparant immediately; but a fortnight later, just after a heavy fall of rain, which washed all the chemicals into the sub-soil, I closely examined the plots. Upon that top-dressed with the Potash Chloride I noticed a marked diminution of the pest. The others were less effective in the following order:—Sulphate of Iron, Gypsum, Quicklime, and Sulphate of Ammonia.

The caterpillars feed at night, being rarely or never found out of their holes during the day. Their favorite food appears to be cocksfoot grass; they eat this above and below the ground. (And unfortunately this is the grass most generally cultivated throughout South Gippsland.) They frequent only the hills; on the flats or places where water would lodge in a wet season they are not to be seen at all. These facts tend to prove that they would not be troublesome in a wet season."

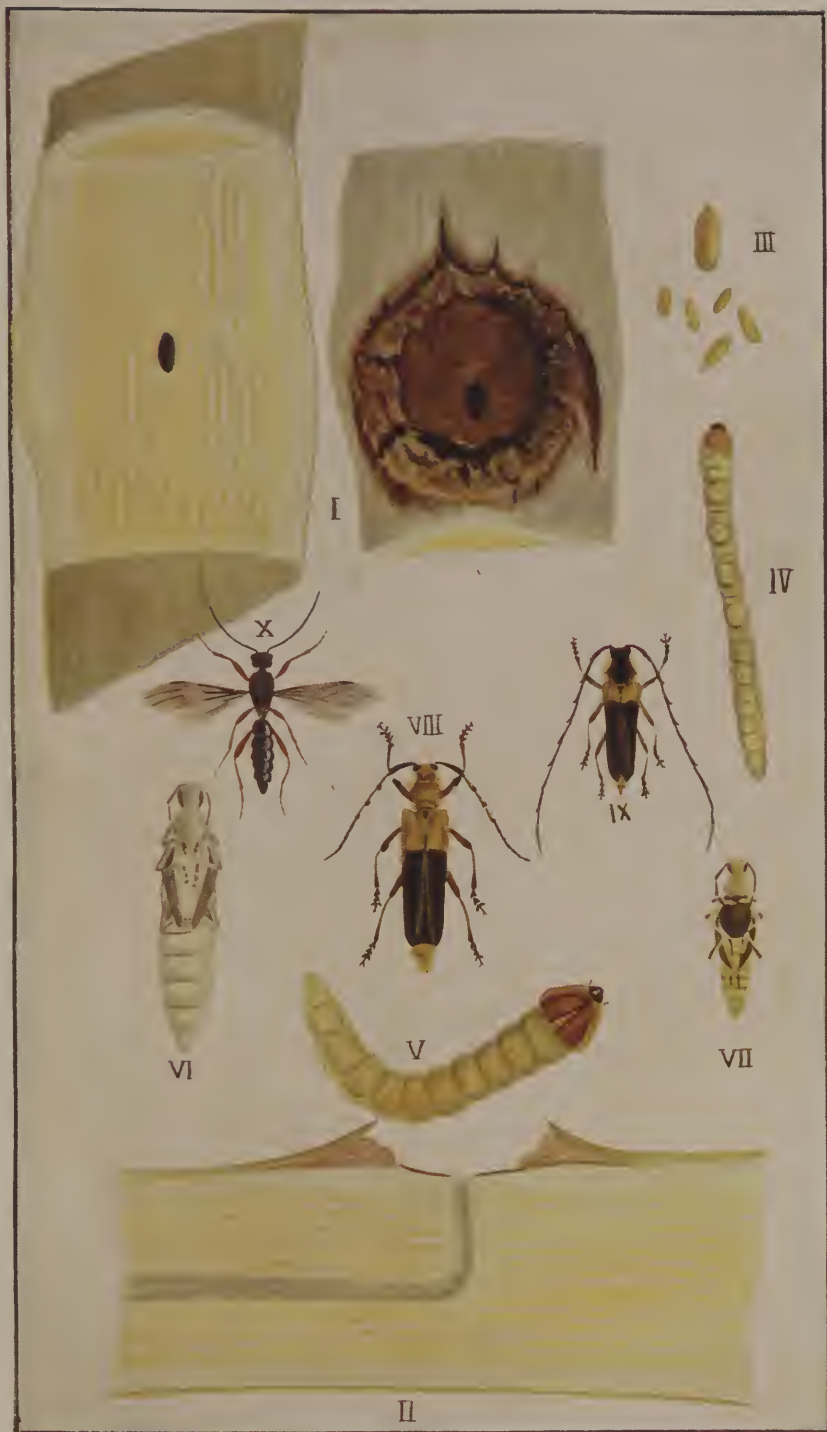


PLATE LXXVIII.

"THE APPLE-GUM BIMIA" (*BIMIA FEMORALIS*, SAUNDERS).

Fig.

- I. Scar on exterior of eucalyptus branch removed with portion of wood to show burrow of larva entering tree. Half natural size. From nature.
- II. Section through scar, showing burrow of larva. Half natural size. From nature.
- III. Eggs. Natural size, and one magnified x 2. From nature.
- IV. Larva of male. Natural size. From nature.
- V. Larva of female. Natural size. From nature.
- VI. Pupa of female. Natural size. From nature.
- VII. Pupa of male. Natural size. From nature.
- VIII. Perfect insect, female. Natural size. From nature.
- IX. Perfect insect, male. Natural size. From nature.
- X. Hymenopterous parasite on larva. Natural size. From nature.



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C. French, Direxit,

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CHAPTER LXXXV.

THE APPLE-GUM BIMIA.

(*Bimia femoralis*, Saunders.)

Order: *Coleoptera*.

This handsome but destructive beetle is a native of Victoria, and, although it is looked upon by collectors as a very rare insect, it may be, if time permitted in the field to investigate the matter, that it is by no means the rarity it is supposed to be.

I am indebted to Mr. Giles, formerly of Melbourne, now of West Australia, for the first life-history specimens of this species, although that of the more common one—*B. bicolor*—has been well known for years. The specimens from which our drawings were taken were collected by Mr. Giles in the Gembrook district of Victoria, as feeding in the thicker limbs of a gum tree (*Eucalyptus Stuartiana*). The female, as the plate shows, is much larger than the male, and both sexes are wonderfully active, even when they have been but a short time out of the wood. I have kept them for days, the eggs, as shown on the plate, having been deposited by the female at the bottom of the cardboard box in which the beetles were kept—the sexes separate.

Victorian forests are, unfortunately, rapidly disappearing, largely owing to clearing, but also because of fires, and the great damage caused by the various kinds of insects; so that knowing the life history of any one of these destroyers may be considered a step towards its eradication, hence the inclusion of forest insects in this book.

In dealing with pests of this kind great difficulties are in the way, as, owing partly to the situation and great height of some of our *eucalypti*, it would be quite

impossible to stamp out these borers by the usual course, which one could adopt were he dealing with an orchard or garden.

B. femoralis appears to work in a somewhat insidious way, as the limb attacked presents but little to indicate the nature of the destructive work going on inside, although the larvæ of *longicorn* beetles (long-horned beetles) will feed for one or more years in the one tree. The larvæ of some of the large *longicorn* beetles from Queensland, which live in the wood of the fig trees, on account of their great size—as in the fine genus *Batocera*—are about four to five inches in length, and do great damage. It is a remarkable fact that a number of the *longicorn* beetles, immediately after their long imprisonment inside the tree, ascend to the top branches, where they remain during the day, flying by night only. This is why many of these beetles appear to be rare, whereas, when their habits are found out and properly understood, they may be quite common.

I could enumerate many instances of beetles appearing to be quite of rare occurrence; but once find out their life histories, and they are no longer considered as rarities, but the reverse is frequently the case.

In speaking of the second species of *Binnia*, *B. bicolor*, I may point to the fact of our well-known field naturalist, Mr. D. Best, having written a most interesting series of articles on the "*Longicorn Beetles of Victoria*," but, as these articles are not available to the general reader, I will, as I proceed, quote many interesting facts as observed by the gentleman before alluded to.

It may be mentioned that our plate, showing the life-history of this beetle, is the first which has been published; the sexes, before these were not well known, having been separated by entomologists into two species.

Prevention and Remedies.

In the forest the greatest success would be brought about by "selection"; that is, a judicious thinning-out

of all weedy and partly-dead trees, the latter being the great resort of borers, to say nothing of the white ants, which, in this decaying timber, live and rapidly increase, only to spread a similar trouble to other and better timbers. All thinnings, when practicable, should be burned, thereby killing off countless numbers of insects, and also greatly lessening the risk of bush fires.

When a forest tree is badly attacked, the only remedy is to cut it down (grubbing it out would be better) and get rid of it as soon as possible. Where eucalypts, acacias, etc., are artificially cultivated, they can often be watched, and, if found to be attacked, a good spraying with kerosene emulsion will kill off all scale at any rate; as, once get a gum scaly, it soon loses its vigor, and is thus an easy prey to borers all and sundry.

PLATE LXXIX.

"THE LESSER CASE MOTH" (*CLANIA IGNOBILIS*, WALKER.)

Fig.

- I. Case of female, showing young larvæ emerging.
Natural size. From nature.
- IA. Pupa, in opened case, female. Natural size. From nature.
- II. Case of male, showing pupa case or skin from which perfect insect (male) has emerged. Natural size.
From nature.
- III. Pupa, and perfect insect, female. Natural size.
From nature.
- IV. Perfect insect, male. Natural size. From nature.
- V. Larva, female. Natural size. From nature.
- VI-VIII. Dipterous flies, parasitic on larvæ and pupæ.
Natural size. From nature.
- IX-XIII. Hymenopterous parasites on larvæ and pupæ of entometa. Natural size. From nature.



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CHAPTER LXXXVI.

THE LESSER CASE MOTH.

*(Clania ignobilis, Walker.)*Order : *Lepidoptera*.Family : *Psychidæ*.

These extraordinary creatures are common anywhere near Melbourne, and may be found at any time in the Melbourne reserves, where they do considerable damage, especially to pines and other members of the *Coniferæ* order of plants by gnawing the bark and leaves off the trees, and, being in large numbers, a good sized tree may be stripped in a very short space of time. In structure and habits the females of the group (see Fig. V.) are, as the late Professor McCoy remarks—"amongst the most abnormal and singular of all *lepidopterous* insects; they are smooth, naked, fleshy, grub-like creatures, totally destitute of wings, and having only rudimentary traces of legs, antennæ, and eyes." Professor McCoy states that these apterous females never leave the sack or case in which they dwell while in the larval stage, but, after meeting the males at the lower aperture of the case, commence to bring forth the young in myriads; these, escaping in crowds, let themselves down each by a silk thread spun from the lower lip until they reach a twig or leaf, and then each begins a separate case of tough silk and extraneous material such as bark, this species specially favouring twigs—as shown on the plate (Fig. I.)—to protect itself during its larval existence. I must here express some doubts as to the correctness of the assertion that the female never leaves the case—which case, by the way, is much larger than that of the male insect—as good observers have noticed that these do occasionally leave the case, but only for a short period, and for the purpose of

mating with the male. With regard to egg-laying, I cannot say for certain whether eggs are deposited by the females of these insects or not; but the bodies of the females contain vast numbers of eggs. The larval sacks or cases are open at both ends, the male caterpillar coming sufficiently out of the anterior aperture to use its three pairs of thoracic legs for locomotion when feeding.

It usually fixes a part to the edge of the aperture by fibres of silk temporarily to the twig it is on, so that, if alarmed, it can suddenly withdraw completely within the case, when it remains with the aperture so completely closed up that, if the nature of the object was not known, it would never be suspected to contain a vigorous and voracious grub or larva.

The young larvæ of these case moths are curious little creatures, and in the early stages are very minute. I well remember a circumstance which happened many years ago. I had a box containing a number of these stick-nests of both sexes, and these I had placed for safety on a shelf about ten or twelve feet from the floor. One evening I was busy arranging some insects in my cabinet, when, on accidentally looking upwards towards the shelf, I noticed a number of long silky threads reaching from the shelf to the floor; I was quite amazed, and could not divine the source of such a singular phenomenon, until it occurred to me to mount the steps and look at my box; and there, to my astonishment, I found a constant stream of these tiny grubs, which were so minute as to be scarcely perceptible. I then obtained a glass-stoppered bottle, and held it directly under the descending larvæ, when in a short time I had it filled with material not unlike the finest webs of the spider. This is a most singular part of the economy of the insect, as the young larvæ at once begin to spin cases for themselves, and commence to eat ravenously.

The males of these stick-moths are hard to find, as, after nearly fifty years of collecting, I have taken only

two specimens, although they are not difficult to rear, and may be attracted in large numbers by placing some females under a wire meat-cover in the open air. The males are strong flyers, both my specimens having been taken soon after daybreak.

Our plate shows the insects in all their stages, and also some of the numerous parasites by which they are attacked, these latter having been all reared by either the Messrs. Hill or by ourselves.

Prevention and Remedies.

These stick-case moths when in the larval stage are most troublesome to growers, as they appear in such large numbers, especially when in the earlier stages of development, that a few trees may be stripped before the grower is aware of the presence of the case-covered grubs in the orchard. Fortunately, however, these grubs are easily prevented if the danger be taken in time, as a spraying of kerosene emulsion will usually cause them to leave for some other place. Hand-picking when the grubs are present is a good plan, but the best of all is to poison their food by spraying the trees with one of the arsenical preparations, such as Paris green, etc.; but, of course, this spraying may have to be repeated. There are certain birds which will tear these cases open for the purpose of getting at the grub concealed within; but, as has been said before, poisoning the food is the cheapest and most effective remedy.

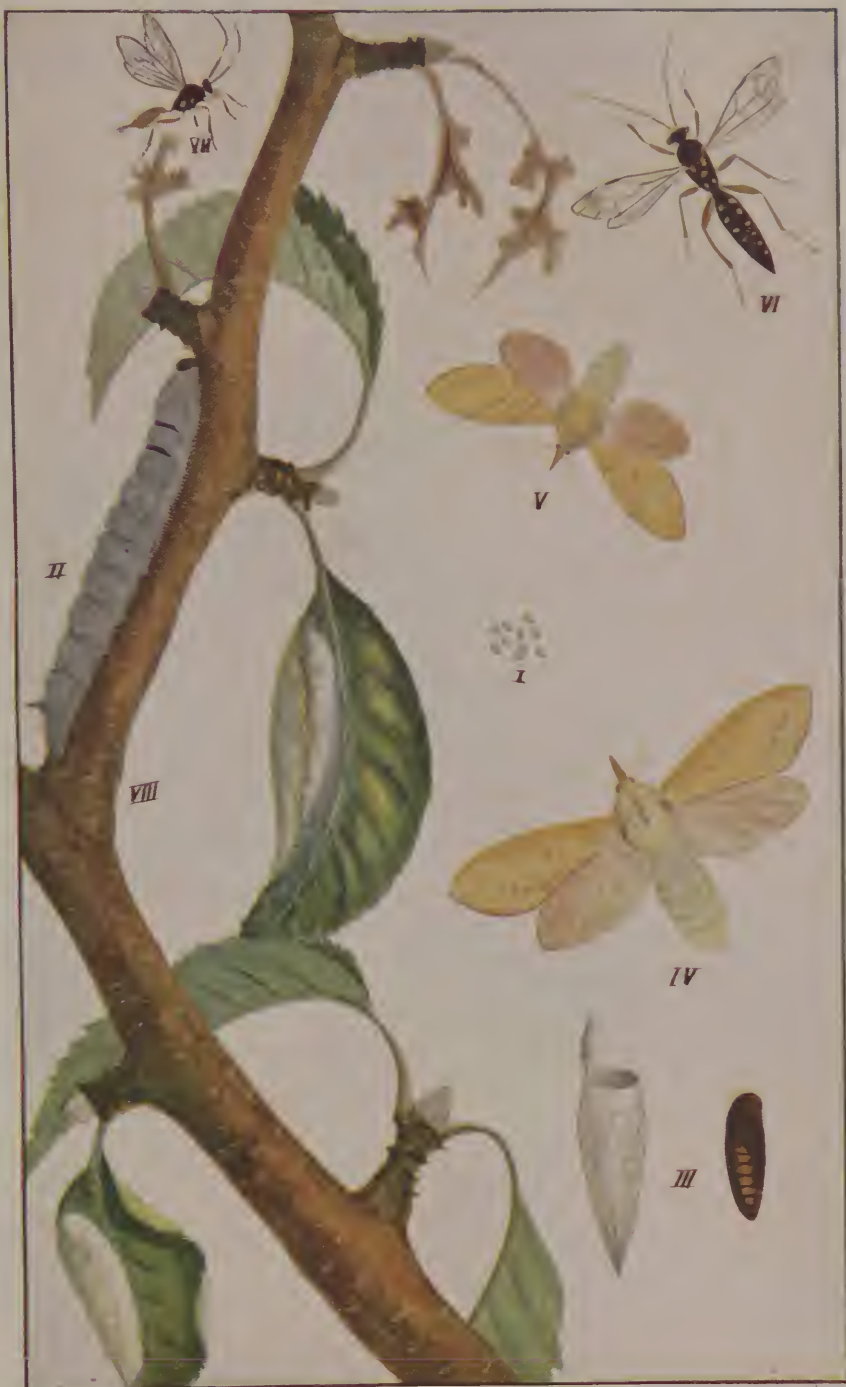
In dealing with this pest when the larvæ are very small, the trees require to be well watched, as, having killed one lot, they appear just as bad as ever in a day or two; but the spraying, if ever so weak, must be persevered with, or else the little "animated" leaf-like cases may astonish the grower by their voracity; and the larger one—*Metura elongata*—will tackle oranges, quinces, vines, etc., etc., as stated in my book, Vol. III. The type of this singular insect is in the National Museum, Melbourne.

PLATE LXXX.

"PINARA GRUB OF THE APPLE" (*PINARA NANA*.)

Fig.

- I. Eggs. Natural size. From nature.
- II. Larva. Natural size. From nature.
- III. Pupa and cocoon. Natural size. From nature.
- IV. Perfect insect, female. Natural size. From nature.
- V. Perfect insect, male. Natural size. From nature.
- VI. Parasites, hymenopterous flies. Natural size. From nature.
- VII. Parasites, hymenopterous flies. Natural size. From nature.
- VIII. Apple branch, with cocoons folded in leaves, also showing damage done to foliage.



C. C. Brittlebank, Del.

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Plate LXXX.

CHAPTER LXXXVII.

THE PINARA GRUB OF THE APPLE.

*(Pinara nana.)*Order: *Lepidoptera*.

This formidable pest of the apple grower was first sent to me by Mr. G. Shepherd, the well-known Somerville orchardist and nurseryman, as having stripped most of the leaves off many of his apple trees. It is a native of Victoria, and formerly had for its food some of the indigenous plants of the State. The moth as figured on our plate is a yellowish drab color, the eggs being deposited in clusters, or patches, on the leaves of the apple. The larva is a most singular looking beast, lying close to the bark (see plate, Fig. II.); and, where the bark of the tree is green, it is almost impossible, without a very close examination, to detect it. The pupa is of a chestnut-brown color, the male of the perfect insect being much smaller than the female; each sex being remarkable, as possessing a snout-like appearance of the frontal part of the head. The larvæ of this species not only roll, but also strip the tree of its leaves, and also are very severe on the buds and young shoots. The larvæ have a singular habit of rolling the leaves of the trees attacked, and in which the pupæ change; and, where the grubs are at all numerous, the process of stripping a tree is speedily accomplished.

In the Somerville and other fruit-growing centres, this pest is very troublesome and destructive. On the plate (Figs. VI. and VII.) will be noticed two kinds of parasitic *Hymenoptera*, which are always on the look out for an opportunity of depositing their eggs in the bodies of their victims, which latter include moths and also insects of other kinds.

Prevention and Remedies.

As a deterrent, spray the trees with kerosene emulsion, and afterwards with Paris green, arsenate of lead, etc., as the caterpillars, living upon the tissue of the leaves and buds, are easily killed by eating the poisoned leaves. I have often watched, but have never yet discovered any bird eating these caterpillars; possibly because, may be, these grubs are not easily found; or they may, as is the case with the common vine-caterpillar, be distasteful to most birds, although some of the cuckoos will devour them readily.

Fortunately the moth is not a very common species, although, like many others of the *Lepidoptera*, the female lays a large number of eggs. If this moth was as prolific as is the pretty little "Painted Moth of Froggatt" (*Teia anartoides*), the apple growers of the State would have a bad time of it, as the larvæ of the Painted Moth have been in thousands, and there is hardly a plant in a garden but what these little pests will strip with extraordinary rapidity, even the hardy Zonale pelargoniums, roses, etc., not being exempt from their attacks. In the arsenical sprays we have a wonderful remedy against all leaf-eating insects, a thorough spraying, in competent hands, being all that is necessary so far as the leaf-eating pests are concerned.

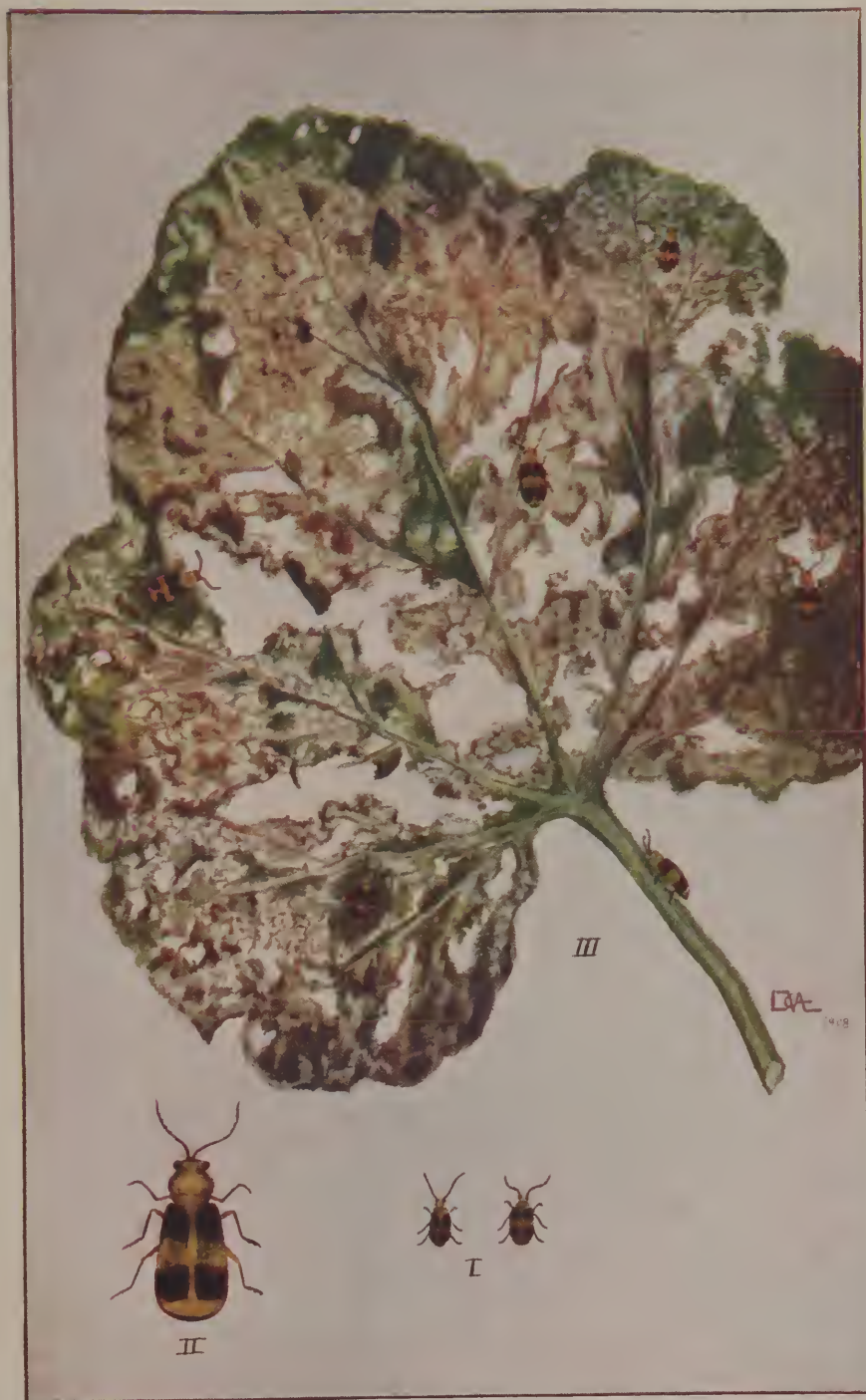
In the case of locusts, green beetles, and a few other pests, the enormous numbers which prevail render it next to impossible to deal with the trouble unless at huge expenditure, which the State may be disinclined to bear.

PLATE LXXXI.

“THE BANDED PUMPKIN BEETLE” (*AULACOPHORA*
HILARIS, BOIS.)

Fig.

- I. Beetles. Natural size. From nature.
- II. Beetle. Enlarged. From nature.
- III. Leaf of pumpkin, eaten by beetles. From nature.



L. C. Vald. Andersen, Del.

C. French, Direxit.

Osboldstone & Co., Print

Plate LXXXI.

CHAPTER LXXXVIII.

THE BANDED PUMPKIN BEETLE.

(*Aulacophora hilaris*, Boisd.)

Order: *Coleoptera*.

Sub-Family: *Gallerucides*.

A handsome little beetle, belonging to the great family of the *Chrysomelidæ*, and so well known for their leaf-eating propensities. This insect is about a third of an inch in length, with a slender head and neck. In color it is a distinct orange-yellow, with a blackish patch in the "shoulder" of each wing case, with a corresponding but more rounded blackish spot on either side towards the tips of its wing cases. So far I have been unable to find either larvæ or the eggs, which are laid on the leaves, so am at present unable to figure them, but trust to doing so later on.

This very destructive beetle, eight species of which are described as being from Australia, is a native of Victoria, and also of other parts of our continent; and has hitherto, with very few exceptions, been looked upon by Victorian collectors as a somewhat rare insect, and, so far as our own State is concerned, a collector may hunt the bush for days together without finding even a solitary specimen; and it is only during the last few years, and at long intervals, that it has proved such a pest to growers.

As a rule, the depredations of this beetle have mostly been confined to plants belonging to the great order of *Cucurbitacæ*, to which belong our pumpkins, marrows, cucumbers, gourds, etc.; and peaches, nectarines, etc., have also been attacked; but of late years their attacks have by no means been confined to the plants above mentioned.

In December, 1895, I was first made acquainted with

the damage these pests were doing in many parts of our State, and now, in 1907-8, there has occurred another and much more serious outbreak, resulting in large losses to growers of pumpkins, marrows, etc.

We have received large numbers of specimens from growers, who state that these beetles have appeared in thousands, eating leaves and flowers of the plants mentioned, leaving only a portion of the leaf stalks on the ground.

In America the Elm-leaf Beetle (*Gallerucella luteola*) has caused damages to the extent of thousands of pounds per annum, and the fine elm trees of New York and other places have suffered badly.

In this pest we have a serious difficulty to face, and, as stated before, it has developed a taste for cherries, peaches, and other soft fruits, so that it is a matter of conjecture as to where its depredations will stop.

In most cases with foliage-eating insects, they are easier dealt with than are *Coccidæ* (or scale insects), Codlin Moth, Root-borer, etc; but the present beetle appears to be of a somewhat robust nature, and fairly powerful washes are required to permanently destroy them. Fortunately these beetles are conspicuous in appearance, and thus are more easily detected than many of our other orchard and garden pests. It may be mentioned that these *chrysomelids* are frequently alluded to as lady-birds, which they of course are not; very few of the latter *Epilachna*, and a few others, being the exceptions; nearly the whole of the so-called lady-birds being mostly useful aids to the grower, and should, of course, be jealously guarded against thoughtless destruction.

Our plate shows these insects at work on a marrow leaf. It would be interesting to find out the cause of these and other insects making their appearance in such vast numbers; and these matters are now being investigated by myself and assistants.

Prevention and Remedies.

The first measures to be taken would commend themselves to practical persons. They would consist of preventives, and for this purpose there are few more useful materials than the following:—Tar water, quassia chips, etc., particulars for mixing and using which may be found near the end of the present volume; also at the conclusion of this chapter.

Should the beetles have settled down to work, be up at daybreak, and before sunrise place sheets under the affected plants, so that vast numbers of the beetles may be captured, and destroyed by means of a bucket of boiling water. When the sun has gained any power, this plan will be of no use, as the beetles are too lively then to be captured in such an apparently innocent manner.

The following washes for spraying affected plants have been tried with more or less success by our field inspectors, who are stationed in many parts of the State:—Paris green, kerosene emulsion, crude oil of tar, the best results having been obtained—according to Inspector Farrell, of Shepparton—by the use of the latter in spray form. Arsenate of lead (Codlin Moth formula) has also been tried with much success.

Growers and others are earnestly invited to communicate with the entomologist should other outbreaks of this pest occur, as we must stamp it out, if at all possible.

Referring again to tar-impregnated water, the writer knows by a long actual experience that there is nothing so effective among young cabbages, cauliflowers, and other plants of the kind, as liberal sprayings, in dull weather, with the tar-impregnated water before-mentioned. The larvæ of the Cabbage Moth are killed instantly by its use, while it also acts as a strong and lasting deterrent; while the cost of the material is almost *nil*. The following notes have been sent by some of the field inspectors:—

Mr. J. Farrell, of Shepparton, writes: “I first observed the Pumpkin Beetles this season about the middle of

October on peach trees. They were apparently eating some of the peach aphids, but this did not last long, as they commenced to attack pumpkins, marrows, etc., about the end of October, and the raspberries later on. These insects are peculiarly gregarious in their habits, as they only associate while feeding and copulating; and at no other time do they show any inclination to go together. When a pumpkin, for instance, has been singled out for attack, its leaves are invariably destroyed one at a time. One of the beetles begins to eat the edge of the leaf; soon the beetle will be joined by another, and so on. Then the insects may increase in numbers, flying from all directions, and taking up positions on the leaf alongside those which have commenced to feed. They work outward from the centre in the form of a semi-circle, and in a short space of time—according to the number attacking the leaf—it will be destroyed, nothing remaining but the stem and the hardened tissues of the leaf. Another leaf is then attacked in a similar way, and so on, until the plant is riddled (see plate), the young leaves in the centre escaping until the last. The beetles are more drowsy in the early morning and evening; and, if disturbed while feeding, some will fly away, whilst others hide among the leaves and flowers; but at midday they are over-active, and, if feeding, they fly away in different directions on being approached. In order to combat this pest, I first used arsenate of lead (Swift's), which was fairly successful, as I afterwards found a number of the beetles dead on the ground. I subsequently used the arsenate, but the beetles came in such numbers that they devoured all the leaves on which the poison had been placed. From this I concluded that, to deal effectually with this pest, some material should be put on the leaves to prevent the beetles from attacking them. I found a strong solution of quassia to be fairly good for the purpose, also phenyle, and dusting the leaves with finely-powdered sulphur."

Field Inspector Pescott, of Bendigo, writes: "I beg

to say that I have found that the two makes of the arsenates of lead, viz., the ordinary and 'Swift's,' are very effective when the beetles attack the foliage. At this season of the year, I dare say, the beetles attack the flowers in preference to the foliage, and thus a spray could not easily reach them. I have observed that the beetles are very sluggish in the early morning, and the easiest method of coping with the pest is to sweep the beetles at this time, with the hand, into a shallow vessel containing hot water and kerosene."

Mr. O'Neil, of Hill View, Cowra, N.S.W., writes: "By this post I am forwarding some beetles, which are very numerous here in the orchards. I have made enquiries about them, and find that they do much damage. A number attack peaches or nectarines, and eat them clean to the stone; or, if they start a hole in one, and then leave, the fruit so attacked rots. They also bite off the green grapes, leaving nothing but the bare stalks; and they do great damage among melons."

Mr. Tryon, Government Entomologist of Queensland, says:—"The pupæ of these beetles are below ground." Hence it is that in suitable weather these pests, like the "Green Beetle" and many others, simply swarm, spending their short lives in eating and in the perpetuation of their kind.

Before closing this chapter, I may mention having just received from Inspector E. Wallis, of Wangaratta, the following as being the quickest and best remedy yet tried against this beetle:—"Crude oil of tar, half pint; soft soap, half lb.; caustic soda, one ounce; five gallons of water. Boil one pint of water, and in it dissolve the soap and soda; add oil of tar; agitate well; now add remainder of water; cool, and use."

Spreading a sheet of newspaper under pumpkin leaves, and now and again shaking the plants, causes the beetles to fall, and they can be picked up from the paper and destroyed. This device can be used at any time, even during the hottest part of the day.

PLATE LXXXII.

"RED GUM-TREE WEEVIL" (*STRONGYLORHINUS OCHRACEUS*,
SCHAUM.)

Fig.

- I. Branch of tree, showing damage done by larvæ. Slightly under size. From nature.
- II. Perfect insect. Magnified. From nature.
- III. Perfect insect, male. Natural size. From nature.
- IIIA. Perfect insect, female. Natural size. From nature.
- IV. Ichneumon, depositing egg in weevil. Natural size. From nature.
- V. Pupa. Natural size. From nature.
- VI. Cocoon of ichneumon. Natural size. From nature.
- VII. Ichneumon, female. Natural size. From nature.
- VIII. Ichneumon, male. Natural size. From nature.



C. C. Brittlebank, Del.

C. French, Direxit.

Osboldstone & Co., Print.

Plate LXXXII.

CHAPTER LXXXIX.

THE RED GUM-TREE WEEVIL.

(*Strongylorhinus ochraceus*, Schaum.)

Order: *Coleoptera*.

It will have been frequently observed by persons accustomed to travelling in Victoria that many of the boles or stems of our gum trees (*Eucalypti*) are disfigured by large excrescences, which, at a distance, have the appearance of a swarm of bees which had settled upon the stem of the tree. Upon closer inspection, however, it will be found that this disfigurement has been caused by the depredations of certain weevils, which form the subject of the present chapter.

My first attention to the destructive work of this beetle is due to the labors of Mr. C. C. Brittlebank, whose name will be familiar to all readers of this book as being one of our best field observers, and the artist who has so cleverly and naturally drawn our illustrations.

In the Myrniong district, some miles from Bacchus Marsh, many of the gum trees are either dead or dying, our plate—drawn some time since—giving but a faint idea of the real damage caused by this beetle.

At Box Hill, ten miles from Melbourne, my assistant—Mr. C. French, Jnr.—has found as many as 210 larvæ in one branch of the yellow box (*Eucalyptus melliodora*), this showing the destructive nature of the insignificant-looking beetle under notice here.

From observations made on the spot by Mr. Brittlebank, it would appear that the eggs of this beetle are deposited one at a time in a hole made by the female in the bark of the tree, which insect bores into the bark with its "snout;" and, having completed this function, deposits one egg only in each hole, then covering the same with

a sticky secretion. Our plate shows the beetles, also the egg and larva *in situ* together with the parasites, which are several.

The perfect insects, which are fairly numerous, and may be shaken from the low branches into an umbrella, are of a brick-red color, the male—as in the rest of the great group of weevils—being smaller than the female.

It is scarcely to be credited that these beetles could cause such singular deformities in gum trees of so large a size, and also cause such wholesale destruction to our gum forests.

Fortunately for us, this beetle has many enemies in the insect world, the Ichneumon Flies being always on the alert, piercing with their tiny ovipositors the soft bodies of both the larvæ and pupæ of the insect, thereby lessening the chances of the beetles arriving at maturity.

Prevention and Remedies.

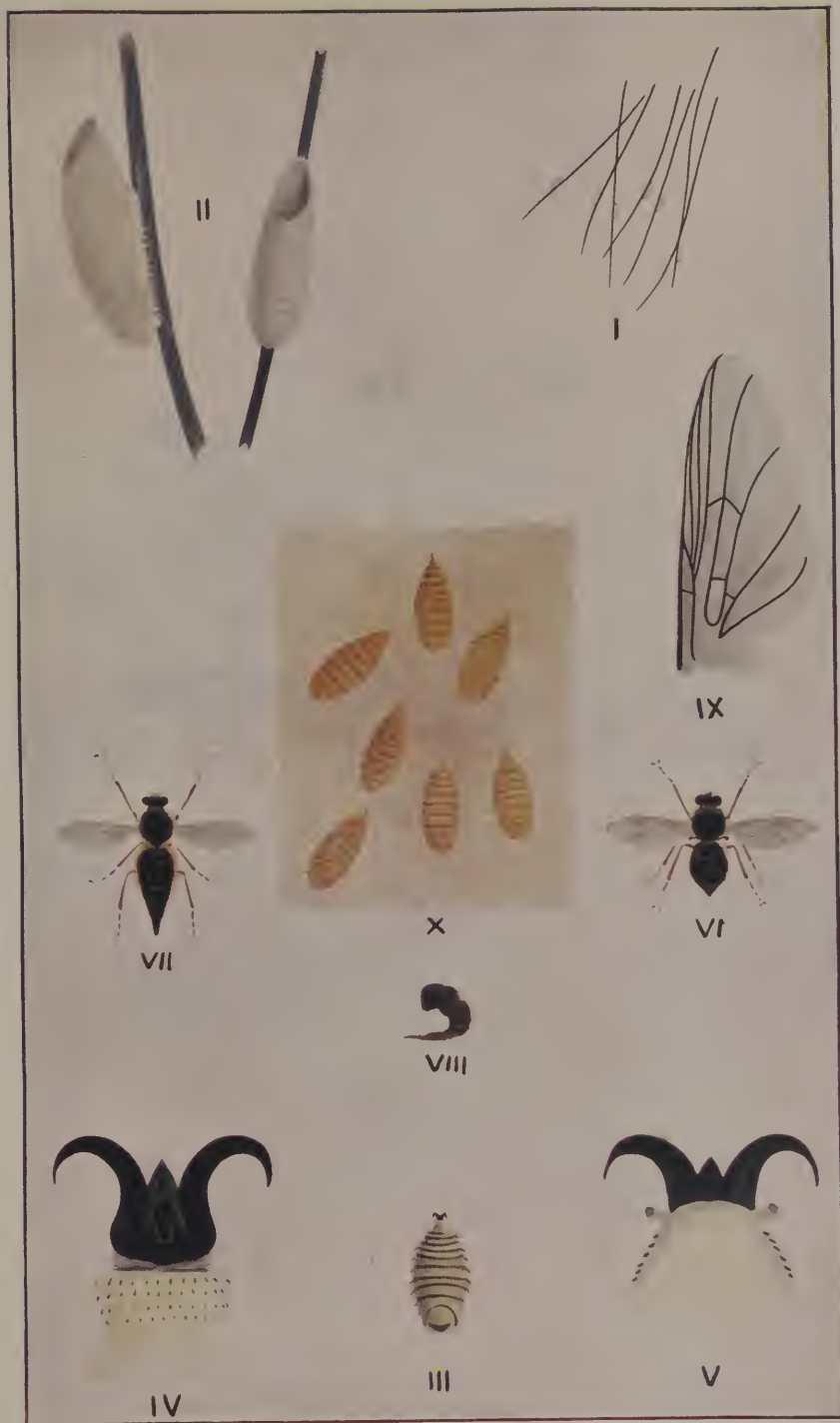
In this case there is practically no preventive; but, where valuable forest trees are found to be attacked, all affected parts of the tree should be cut off and destroyed by burning; and, as the beetles are easily captured, the number of the latter, by the exercise of a little care, may be greatly lessened, thereby preventing the egg-laying and the consequent increase of the pests; and, in this connection, the Forest Department of this State has a great and useful duty to perform, which is incumbent upon them to tackle in a practical manner.

PLATE LXXXIII.

"BOT FLY" (*GASTROPHILUS EQUI*, FABR.)

Fig.

- I. Eggs on hair. Natural size. From nature.
- II. Eggs on hair. Magnified. From nature.
- III. Larva. Natural size. From nature.
- IV.-V. Mouth-hooks. Magnified. From nature.
- VI. Perfect insect, male. Natural size. From nature.
- VII. Perfect insect, female. Natural size. From nature.
- VIII. Abdomen of female, side view. Natural size. From nature.
- IX. Wing. Magnified. From nature.
- X. Portion of stomach, showing Bots attached to same. Slightly reduced. From nature.



C. C. Brittlebank, Del.

C. French, Direxit,

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CHAPTER XC.

THE HORSE BOT FLY.

(*Gastrophilus equi*, *Fabr.*)

The present chapter on this pest of the wild, also of the domesticated, horse is mainly taken from the late Miss Ormerod's articles kindly sent to me by the writer, also from the personal observations of others, including myself; the illustrations on our plate having been drawn by Mr. Brittlebank from nature—from specimens in the museum at my office. In the case of the "Horse Bot Fly," sometimes also called the "Horse Bee," the method of infestation may be shortly described as follows:—The female fly (Fig. VII.) lays her eggs for the most part on the hairs of the mane, shoulders, and chin, or on the forelegs, where they can be reached by the tongue of the horse. By this means the eggs, or the maggots hatching from them, can be readily licked into the mouth, and then the maggots pass down into the stomach (Fig. X.). There they fix themselves by their mouth hooks (Figs. IV. and V.), and feed by suction till after three-quarters of a year (but a much shorter time in Victoria—C.F.); when they are full grown they lose hold, and pass out of the horse in the usual manner. In the dung or in the ground they bury themselves, and turn to a hard, dark colored crysalis, in which the fly forms, and from which it comes out, in summer, after about six or eight weeks (in Victoria probably about half that period—C.F.). This is the life history shortly given, but the following details describe the chief points of infestation, of which the knowledge is commonly needed for practical use. The flies (Figs. VI. and VII.) are half an inch, or somewhat

more, in length and clothed with wool-like hair. The body between the wings is covered with reddish or olive-brown hairs, and some black or dark markings; but the mixture of black, whitish, yellowish, and brown hairs, makes it very difficult to describe the coloring clearly, and the descriptions of the writers vary very much. The two wings (Fig. IX.) are generally transparent, though sometimes opaque, and white with a smoky or brownish cross-band, the legs being yellowish-brown.

The male (Fig. VI.) is rounded at the end of the abdomen, commonly called the tail; the female is more prolonged to a bluntly pointed shape, but when at rest this part, which includes the ovipositor or egg-laying apparatus, is covered under the body. When the fly is about to lay, she hovers for a moment or so about the horse, then, darting down, leaves an egg on a hair (see Figs. I. and II.), fixed by a kind of gummy matter to the hair she has selected, and she so goes on until her stock of eggs is exhausted. The eggs are yellowish-white, about one-twelfth of an inch in length, spindle-shaped at one end, and attached by the narrow end, the truncate end being free and pendant, and several eggs may be placed on the one hair; and it is stated that several hundreds may be found on the one horse.

The hair of the mane and shoulders are parts specially chosen for egg-laying, so that commonly the horse on which they are laid can reach them with its tongue; but, if not, the nibbling or licking of one horse by another, which may often be seen going on in the field, answers every purpose for maggot transportation. There appears to be some difference of opinion, as expressed by various writers, as to the conditions in which the infestation is carried into the mouth. It may be that the egg itself is carried in on the tongue; but one of the more recent views is, that the warm moisture of the horse's mouth hatches the eggs, or rather frees the maggots from the eggs if hatching time is near.

Another view is, that the maggots on hatching crawl on the skin, and thus cause a slight itching, which induces the horse to lick the skin; and thus, in either case, the maggots may be conveyed into the mouth. Hence, although it is possible that some stay by the way, most of them pass downwards with the food into the stomach, where they fix themselves to the white membrane, which lines what may be called the "gullet end" of the stomach. In general "they fix themselves on the gastric mucous membrane, and almost exclusively in the left sac, though some stop in the œsophagus, in the part where the membrane offers the same characters as in the left sac of the stomach." By the same authority (Professor L. Neumann), it is noted that the numbers found in one stomach have been counted from ten or more up to hundreds, as 600, 700, or even 1000, and are stated to be collected in one or more groups, one of which is always larger than the others. The maggot when first hatched is long, narrow, and somewhat worm-like; but in the stage in which it is best known, up to the first moult, it is of the shape shown in Fig. III.—For the greater part of its length barrel-shaped, banded round with rows of prickles or horny points, blunt at the "tail" end, widest at the middle, and gradually lessening in size towards the foremost end, in which is a slit or opening, that serves the purpose of sucking in food, with a brown hard hook (see Figs. IV. and V.) on each side. When full grown, the maggots are about three-quarters of an inch in length, and yellowish-drab in color; early in life they are red or flesh color.

When the process of fixing themselves has been observed, it is noted that they draw back the mouth hooks until the points are close together, then, keeping them side by side, use them as a boring instrument, until whatever they are working at is well pierced. Next, spreading the hooks sideways, and dragging them downwards, the maggots secure such a firm hold that no

more trouble is needed to keep them in place. When full fed, which in England is about ten months, they loosen their hold and pass along the intestines, and are discharged by the animal chiefly during the summer season—in Victoria from November to April. Then they bury themselves in the horse-dung, and in a space of from twenty-four to forty-eight hours turn to chrysalids, forming outside of the maggot, and much resembling it in general appearance; in color, after the first twenty-four or forty-eight hours, of a light brown, changing to dark brown, almost black. From these chrysalids the fly comes out, after about four or five to seven weeks in summer (England).

Mr. Froggatt also gives, in the New South Wales Agricultural Gazette, a very interesting account of the Bot Fly and its doings in New South Wales. In Victoria the Bot Fly is a comparatively recent pest—that is, in the olden days of the colony little or nothing was heard of it. Now we are confronted with the fact that the Bot Fly is becoming by far too frequent an occurrence, and it is remarkable with what dread this pest is regarded by horses generally. One singular fact is, that a horse may be surrounded by swarms of “blow flies,” but does not appear to take any notice of them, but, let even a single perfect specimen of the Bot Fly come near, the horse seems to know instantly what it has to fear from the presence of the “fly.”

With regard to the egg-laying, I have frequently seen the eggs deposited on the manes of horses, sometimes without the animal being aware of the eggs having been deposited; so there need be no discomfort, but simply terror of the fly in question.

Mr. Froggatt mentions that he had examined some Bot Flies, in the National Museum collections, Melbourne, and that these specimens were named *G. salutaris*, and were identical with one sent to Mr. Froggatt from Wagga, New South Wales. Walker describes four specimens as found in England, and Mr.

Froggatt thinks that some "Bots," taken from New Zealand and killed at Botany (N.S.W), belonged to this species.

Prevention and Remedies.

To the farmer and grazier, this is the most important part of the business, and it is a question concerning which there is in Victoria, even among the most skilled veterinary surgeons, a great diversity of opinion; the general belief prevailing among some of our most prominent veterinary experts is that deaths of horses caused directly by Bots are rare, but that the presence of the Bot Fly larvæ, if the horse be not in a good state of health, aggravates certain complaints, thus indirectly causing death.

In Victoria, and, it may be suspected, in many other places also, it is customary to attribute the death of horses to Bot Flies, when in reality this pest has had nothing whatever to do with it. As an illustration, one of the many which could be given, I may mention a case to which I was called, viz., that of a horse which had died, it was supposed from injuries which had been caused by Bot Flies. Upon arrival at the place, accompanied by the then Acting Inspector of Stock, Mr. Stevens, I found that the horse had been interred before we reached there; so it was decided to exhume the body, which task was quickly accomplished by means of a hastily arranged bush "block and tackle." Upon dissection it was found that the gullet of the horse contained some hard substance, and when the gullet was cut open, a "roll" composed of bran and chaff had become hardened, thus causing the death of the horse partly by strangulation.

When other parts of the body were opened, a good many Bot Fly larvæ were found, clinging—as is their habit—to the membranous lining of the stomach, so that the theory of the horse having died from the attack of Bots was entirely disproved.

It has been observed that horses, which looked sickly, were found upon dissection to be quite free from Bots; while, on the other hand, healthy-looking horses were known to be affected; hence we have good grounds for supposing that, in Victoria at least—and leaving out the fact that Bot in its perfect state terrifies horses to such an extent as to render them sometimes unmanageable—the Bot Fly is not quite so formidable a pest as is generally supposed.

When a valuable horse is supposed to be affected, a veterinary surgeon should, if possible, be at once consulted (there being quacks in the veterinary line as well as in other branches of medicine). It is not the intention here to suggest remedies; but, as a preventive, a good plan is to watch your horse carefully, and an occasional painting of the susceptible parts with kerosene will often act as a deterrent by preventing the female Bot Fly from depositing her eggs upon the animal.

In the case of unbroken horses, these could be driven into a "crush," and then treated as above described.

Following upon an article written by myself, Mr. Weir, Chief Inspector of Stock for Victoria, has made the following observations as to prevention and treatment of horses affected with the larvæ of the Bot Fly:—"The mortality from the presence of the grubs of the Bot Fly in the stomach of the horse is happily almost *nil* in this State. Odd deaths certainly do occur; but, when the animals are well nourished, losses are very rare. Those whose business it is to destroy many horses annually, and others who have had special opportunities for observation, are practically unanimous in expressing the opinion that but little harm is done by the Bots to well-cared-for horses. It is often noticed, after death, that animals in which the presence of the grubs is not suspected may have large numbers present, while others again, considered as probably affected, may prove quite free. The Bot Fly has many natural enemies (I am not so sure about this—C.F.), which suffice to keep it in check

to a great extent, and, so far at least as the coastal districts are concerned, its numbers have steadily decreased in recent years.

Prevention is, of course, a wise measure, as great annoyance is thereby saved. Any greasy substance may be applied under the jaws, and about the neck, shoulders, and legs, and will largely prevent egg-laying. As good a plan as any is to fix a piece of cloth under the neck and behind the jaws. The flies are usually more plentiful near water, and about cow sheds; and stabled horses, as a rule, suffer more than those grass-fed, since the former, by rubbing against the feed boxes, introduce the eggs into their food.

Remedies are numerous. Tansy tea is said by some to be almost an infallible method of expelling the grubs. A simple and clean remedy is as follows:—"First prepare the horse a course of bran mashes, and then after a fast give a drench of one or two quarts of new milk, to which half a pint of treacle is added. The Bots seize upon the palatable food with avidity, and gorge themselves; and, as a consequence, many let go their hold. After an interval of about two hours a purgative can be given, consisting of raw linseed oil and oil of turpentine. The dose should, of course, be proportional to the size of the horse. An ordinary hack will require about a pint of raw linseed oil and about two ounces of oil of turpentine. After this treatment most of the grubs will be expelled, and may be destroyed by burning the droppings, always a safe measure in dealing with intestinal parasites."

It is pleasant to know that, so far as we are aware, the "Warble-fly" has not been established in Victoria. The one case brought under my notice being that by the late Mr. Pentland, then Chief Inspector of Stock, the trouble having occurred in the case of an imported cow, which was, however, successfully treated in my presence by Mr. Pentland, the said cow having been in the Quarantine Station at Coode Island, on the lower Yarra,

Victoria. Facts, being stubborn things, I feel I cannot close this chapter without giving our readers some particulars of an old bush remedy, which, from personal observation, I have more than once seen successfully tried, and which I can vouch for. It is to give the horse a drench of warm blood, which has the effect of causing the larvæ to lose their hold, when the grubs are passed by the horse in the usual way. In the bush it is not always possible or convenient for the farmer to consult a "vet.," and in such cases, innocent and homely measures should not, in my opinion, be despised.

PLATE LXXXIV.

“THE PAINTED CUP MOTH,” AND “MOTTLED CUP MOTH”
(*LIMACODES LONGERANS*), AND (*DORATIFERA VULNERANS*,
LEWIN.)

Fig.

- I. Branch of gum-tree (*Eucalyptus*), showing larva at work on leaves, and cocoon attached to stem. Natural size. From nature.
- II. Male of perfect moth (*Limacodes longerans*). Natural size. From nature.
- III. Female of perfect moth (*Limacodes longerans*). Natural size. From nature.
- IV. Male of perfect insect (*Doratifera vulnerans*). Natural size. From nature.
- V. Female of perfect insect (*Doratifera vulnerans*). Natural size. From nature.
- VI. Branch of apple tree, showing larva at work on leaves; also pear-shaped cocoon. Natural size. From nature.



C. C. Brittlebank, Del.

C. French, Direct.

Osborn & Co., Print.

CHAPTER XCI.

THE MOTTLED CUP MOTH.

(Doratifera vulnerans, Lewin.)

THE PAINTED CUP MOTH.

(Limacodes longerans.)

The vernacular name of the Cup Moths has been adopted on account of the singular woody and cup-shaped cocoon, so well known by reason of the little lid which forms the cocoon into a sort of miniature casket.

The moths of this group are sturdy creatures for their size, and are clothed with hairs of a brownish color, the females being—as our plate will show—much larger than the males. The larvæ of these moths are most singular creatures, being flat and soft on the under side, and raised, saddle-like, on the upper side, the upper part being partly covered with clusters of spines much after the shape of the well-known “Sea Anemone.” These spines can be withdrawn at the pleasure of the insect, and, when handled by the incautious, produce a sharp, stinging sensation; and, on this account, the larvæ have earned for themselves the name of “stingers,” by which term they are well known to schoolboys and others living in the rural districts of the State.

The larvæ of these Cup Moths cannot well be mistaken for those of any other moth, their curious appearance, flat shape, and bright green and yellow colors being well known to those having forest matters in their charge.

Of late years especially the larvæ of the Cup Moths have been strongly in evidence as some of the worst enemies of our forest trees. A few years ago my

attention was directed to the great destruction of timber which was taking place in the Rosedale and other districts of Gippsland; and these larvæ were suspected by the late Dr. A. W. Howitt—who was himself a lover of trees, and an authority on Australian eucalypts—to be the principal culprits. I visited the districts, and found that the doctor had been correct in his surmises, as hundreds of acres of trees largely composed of red gum (*Eucalyptus rostrata*) had been stripped of their foliage by these grubs; and, as this work of destruction had been going on for some years, the trees became exhausted, and were dying off by the hundreds, the larvæ of the pest being present in countless numbers.

Successful treatment seemed to be out of the question, as the great height of the trees rendered any spraying impossible, when, fortunately, a terribly long-sustained drought was broken by a very severe thunderstorm, followed by a great rain and hail, the combination of these downpours having evidently destroyed the greater part of the larvæ; and thus further encroachments from this pest ceased, at least for a season or more.

The eggs of these moths are deposited in large numbers amongst the loose bark of the large eucalypts, and the newly-hatched larvæ crawl up the tree, and at once commence to eat the whole surface of the foliage. The larvæ lie, and crawl flat along the surface of the leaves, and without the jerky motion so frequently noticed in the caterpillars of some moths.

The grubs of these moths are mostly voracious feeders, and are evidently not relished by birds, which latter—so far as a long bush experience serves me—seldom, if ever, eat these small, though handsome, caterpillars.

Mr. Froggatt, in his valuable work, "*Australian Insects*" (a book which, by the way, no working entomologist, naturalist, or fruit grower should be without), makes mention of these larvæ attacking the foliage of apricots; and in our own State they are known to attack apple trees also.

It may be interesting to remark that the recent discovery of the larvæ of *Doratifera vulnerans* attacking apples is by no means so recent as many suppose. Mr. Pescott, the inspector under this office (then in charge of the Orbost State School), drew my attention in 1900 to the fact of these grubs having become orchard pests. Mr. Pescott, in his report, states:—"I first observed the larvæ of the Cup Moth attacking the foliage of apple trees, in the year 1900, at Orbost (Victoria). At Stuart Mill, near St. Arnaud, in February, 1908, I found a large number of these larvæ at work on the apple trees in the orchard of Mr. J. G. Hayes. They were very voracious feeders, and at least nine or ten larvæ would be found on the one leaf. Up till the time the larvæ were about half-grown they ate only the epidermis of the leaves, so that the result was very similar to the work of the pear slug. From the time the larvæ were half-grown, until they were full size, they devoured the whole of the leaf, excepting the mid rib and the main veins, leaving the remaining portion very ragged and uneven. My observations did not proceed any further than this, as I did not return there again."

Referring again to Mr. Froggatt's remarks about these grubs attacking the apricots in New South Wales, he says:—"In feeding upon the gum leaves, they move along, ploughing a furrow out of the epidermis with their sharp jaws, so that a tree infested with them has its foliage covered with brown scars; but, the leaves of the apricot being so much thinner, they eat the whole of them, often stripping every leaf off the branches. The caterpillars are fully grown in April (in N.S.W.), and the moths emerge in November. The caterpillars of this moth have a very persistent enemy in one of the large Ichneumon Wasps (*Merosternus albopictus*), which deposits its eggs upon the grubs before it begins to spin its cocoon; and, when the wasp is full grown, it gnaws a circular hole through the side of this prison, as, unlike the moth, it is unable to push the lid off."

Prevention and Remedies.

In Victoria we have a somewhat similar parasite which works great havoc amongst the grubs; and in this connection, I think, we may with safety attribute the periodical scarcity of this pest, which is so noticeable in most of the forest lands of our State, to the above-named cause.

Other natural causes, such as bush fires and storms, without a doubt assist materially in keeping a check on the number of these grubs, which, if not thus destroyed, would largely help to ruin the greater portion of our forests.

In plantations of young trees, the pest may be kept in check by spraying with the following:—One lb. Paris green (paste form being the easiest to use); four lbs. lime, well mixed, strained, and diluted with 150 gallons of water (for ripened foliage); and, of course, somewhat weaker for the younger and more tender growth. This treatment of trees is both simple and most effective; and for taller trees—say up to forty or fifty feet in height—a powerful pump and a frame erected on a lorry being all that is necessary for good and effective work.

Where fruit trees are affected, the usual spraying of either Paris green or arsenate of lead will soon make short work of the attacking grubs.

Mr. C. French, Jr., has made the discovery of a disease of bacterial origin, which turns the grubs a yellowish-brown color; and grubs so attacked usually shrink and rot away. This disease was first noticed by my son, and was common in the years 1906 and 1907. The economy of these two moths being so much alike, we are relying upon the figures on our plate for further information as to color, etc. Both kinds of this moth are common also in New South Wales and in some of the other States.



C. C. Brittlebank, Del.

C. French, Directr.

Osboldstone & Co., Print

"MASKED WOOD SWALLOW."
Artamus personatus, (Gould.)

Plate LXXXV.

CHAPTER XCII.

THE MASKED WOOD-SWALLOW.

(*Artamus personatus*, Gould.)

This beautiful and valuable insect-destroying bird was formerly almost unknown anywhere near Melbourne. I allude to the early fifties, when cover for most birds was plentiful; the so-called White-eyebrowed Wood-Swallow, or Summer-bird, being plentiful everywhere. Old colonists prefer the name of Summer-bird, as the appearance of these birds, in vast numbers, could always be relied upon as a sign that summer was close at hand. I have seen thousands of the White-eyebrowed in various flocks, and, as soon as they arrive, they commence at once to build and to lay their eggs. The subject of the present chapter is one of the handsomest of the genus *Artamus*, being of a grey color, lighter and more delicately colored on the breast and other under portions of the body. The face, ear-coverts, and throat are black, and sharply cut in color outline (see plate), forming a sort of mask; hence its vernacular or common name.

The Masked Wood-Swallow occasionally visits Victoria in large numbers, the writer having seen large flocks of them at Pakenham, Nar Nar Goon, and other places on the main Gippsland railway line. This was in November, and nest building was then being carried out with vigor. The flimsy nests are usually composed of twigs, grass, and pieces of rushes; and, like the other kinds of summer birds, are almost quite transparent. The nests are usually built fairly low down, frequently on the top of an old stump, and in this easily seen position the eggs are taken by boys in a wholesale manner.

The eggs (two or three in a clutch) are deposited in these nests, and may be seen through the nests by looking upwards from the bottom. The females are

sometimes fairly pugnacious, and in defence of their eggs, and especially of their young, will fly at anyone venturing near the nest; but this fluttering has the opposite effect than that for which it was intended, as it draws the attention of passers by to the place where the nest really is, and both the bird and its eggs generally suffer in consequence.

In Mr. Campbell's valuable work on "*Nests and Eggs of Australian Birds*," the writer remarks:—"This handsome Wood-Swallow and the *A. superciliosus* are probably more nearly related than are any other two of the *Artami*, the fact already recorded by me of the female *A. personatus* being mated to a male of *A. superciliosus* would tend to prove that assertion; besides, oologically speaking, the eggs are inseparable, as far as outward appearances go. The voices of the two species are very much alike; but the 'whamp' like alarm note of the *A. personatus* is somewhat coarser and deeper."

In his "*Insectivorous Birds of Victoria*," Mr. R. Hall says:—"By the middle of December, many of each species were preparing homesteads for the third brood, and they seldom use the nests of a past family for a future one. Late builders were observed, in the early portion of this month (January), carrying twigs. After sundown those birds not engaged in the night tasks of caring for the young or the eggs congregate in bodies, of from ten to fifteen, close together, in a tree or shrub convenient to the nests and near the ground. It may be a large fruit tree, a sweet briar bush, or one of the many other vegetable forms. With both kinds I find that one egg is deposited each day, and the first of the clutch hatches out on the twelfth day of sitting. The young, of the two species, fly upon the eleventh or twelfth day from hatching, subject to a slight variation in a number of broods."

The food of Wood-Swallows consists, so far as the writer has observed, strictly of insects; and it is

amusing to watch them bustling about among the grass tussocks, so that when a moth, on being disturbed, flies upward, it is at once pounced upon, and either devoured upon the spot, or carried off to the nest. Grasshoppers appear to be a favorite food for these birds, as they follow up the swarms of hoppers, making great havoc among them. It has been asserted that this bird will kill bees; I am not prepared to contradict this, although the quantity of bees eaten is very small indeed, and is hardly worth mentioning. It is hardly to be supposed that these birds have had sufficient entomological training to enable them to discriminate between bees and many other flying insects, so that a few bees are possibly secured as victims. The large *Cicada*, commonly known to boys as locusts, which they are not, are also tackled by these birds, the writer having frequently seen the birds listening, for the purpose of locating the exact spot on the tree from which the shrill stridulation comes; and, this found, a bustling amongst the leaves usually starts the *Cicada*, which go whirring away in the air, until frequent attacks by two or three of the birds, acting in concert, usually seal the fate of the captive.

This bird has a wide geographical range, being found in New South Wales, Victoria, South Queensland, South Australia, West and North-West Australia.



"BABBLER," or "CODLIN MOTH BIRD."
Pomatorhinus temporalis, (Vigors and Horsfield.)

Plate LXXXVI.

CHAPTER XCIII.

THE BABBLER, OR CODLIN MOTH BIRD.

(*Pomatorhinus temporalis*, Vigors and Horsfield.)

The Babbler is commonly, but erroneously, known as the "Cat Bird," probably because, when a number of these birds are gathered together, they resemble in the noise they make the mew of the cat; so that a stranger, hearing them for the first time, would naturally conclude that several cats were in the vicinity.

The bird is undoubtedly one of the orchardist's best friends, as it has a distinct partiality for the larvæ and pupæ of the Codlin Moth. On a visit to Somerville some time ago, my attention was drawn by Mr. George Shepherd, the well-known orchardist, to a number of these birds in an orchard, some distance from his nursery. They were very busy climbing up and down the apple and pear trees, hunting in the crevices of the bark, and under the bandages, for the grubs; and as at least a dozen birds were engaged in this useful and self-imposed task, their combined efforts would result in a very decided benefit. Incidents like these are of almost every day occurrence, and serve to give some idea of the value of these birds as insect destroyers.

Gould states that the sexes do not differ in outward appearance, and may thus be described:—"Throat, centre of breast, and a broad stripe on each eye, white; lores and ear coverts, dark brown; centre of the crown, black; and sides of the neck, greyish-brown, gradually deepening to a very dark brown on the wing coverts, back, and scapularies; wings very dark brown, with the exception of the inner webs of the primaries, which are rufous for three-fourths of their length from the base; tail

coverts and tail, black, the latter largely tipped with pure white; abdomen and flanks, dark brown stained with rusty red; bill, blackish-olive-brown, except the basal part of the lower mandible which is greyish-white; irides in the adult, straw-yellow, in the young, brown; feet, blackish-brown."

The nests are bulky, with the entrance at the side, and are composed of dried sticks or rootlets, lined with fur, bark, or other similar material. It is a well-known fact that several birds assist in building a nest. On the Lower Werribee, on the 6th November, 1894, Mr. C. French, Junr., flushed a Rose-hill Parrakeet from one of the bulky nests of the Babbler, and took six eggs of this Parrakeet therefrom. This is, I believe, the first record; and several other persons have since noted the same fact.

Unfortunately, these nests are easily detected, or are often placed within the reach of mischievous small boys. Some I have noticed in small gum-trees and she-oaks, only a few feet from the ground, where they are easily robbed by the professional egg collector and others; and, of course, many young birds are thus destroyed. When disturbed they fly on to the lower branches of a tree, and hop from limb to limb.

The interesting statements made by Mr. Campbell in regard to the habits of these birds, to the effect that several retire to the one nest at night, I am able to confirm from my own observations. On many occasions I have observed several birds fly from a nest, when the inmates were disturbed, just about dusk. The nesting habits of this genus, as Mr. R. Hall remarks, are rather strange. About half a dozen nests are built before eggs are laid in the final one, and it is a very great advantage for the birds in adopting this means, perhaps unconsciously, for the preservation of their eggs.

The eggs are of a brownish-grey color, with cobweb-like markings, as shown in our plate; the markings being easily washed off. The clutch usually consists of

four or five eggs, but Mr. North states that Dr. J. Ramsay once took fourteen from the one nest, and which he had no doubt were the joint property of several birds.

Breeding takes place principally in the months of September, October, and November.

Mr. A. J. Campbell and other observers record the existence of the Babbler in Queensland, New South Wales, and South Australia, as well as in Victoria. The Babblers are true insect-destroying birds (stomachs of these birds, examined, having contained remains of beetles and gravel); and, as such, should be protected against all comers.



C. C. Brittlebank, Del.

C. French, Direxit.

Osboldstone & Co., Print.

"NANKEEN KESTREL."

Tinnunculus cenchroides, (Vigors and Horsfield).

Plate LXXXVII.

CHAPTER XCIV.

THE NANKEEN KESTREL.

(*Tinnunculus cenchroides*, Vigors and Horsfield.)

This beautiful bird, which is found over nearly the whole of Australia, is a most valuable aid to the grazier, especially as it will destroy both grasshoppers and crickets, as well as many other pests, in a wholesale manner. The description—which we cannot do better than take from the writings of the great ornithologist, the late Mr. Gould—is as follows:—"The male has the forehead white (our plate shows the color somewhat darker than it should be); head and back of neck reddish-grey, with the shaft of each feather black; back, scapularies, and wing coverts, cinnamon-red, with a small oblong patch of black near the extremity of each feather; primaries, secondaries, and great coverts, dark brown, slightly fringed with white; the base of the minor webs of these feathers white, upon which the dark coloring encroaches in a series of points resembling the teeth of a large saw; face white, with a slight moustache of dark brown from each angle of the mouth; chest and flanks buffy white, with a shaft of each feather dark brown; abdomen and the under tail coverts white; upper tail coverts and tail feathers, for two-thirds of their length from the base, grey; remaining, all but the two centre feathers, white, crossed near the tip by a broad distinct band of deep black, the band being only on the inner web of the external feather; cere and orbits yellowish-orange; legs orange. The female has all the upper surface, wings, and tail, cinnamon-red, each feather of the former, with a dark patch of brown in the centre, assuming the shape of arrow-heads on the wing

coverts; the scapularies irregularly barred with same, and the tail with an irregular band near the extremity; throat, vent, and under tail coverts white; remainder of the under surface reddish-buff, with a stripe of brown down the centre of each feather."

The subject of this chapter is fairly common in many parts of Victoria, feeding chiefly upon insects, such as grasshoppers, crickets, grubs, beetles, etc. As a rule, this hawk does not attack birds, but is a deadly enemy of mice, which latter beast it destroys in large numbers. Mr. A. J. Campbell, in his valuable work on the "*Nests and Eggs of Australian Birds*," says that the Kestrel also destroys small snakes, and justly adds:—"Who would kill a bird of such usefulness?" To those who know but little of bird life, the Kestrel may be known by its color; also by its small size, as compared with other hawks—the sparrow-hawk, a courageous little brute, of course excepted—the specimen in the office collection being thirteen inches from tip of bill to tip of tail. The flight of this bird, except when hunting, is buoyant, easy, and graceful, with occasional darts forward when in pursuit of its prey. This bird appears to like level or "plain" country, interspersed with light timber; but also frequents bare plains on which not a single tree exists, such, for example, as the Keilor Plains, near Melbourne.

In the early fifties, travellers from Melbourne to Bendigo were accustomed to see great numbers of these birds, sometimes soaring to a great height, and, at intervals, descending with a rapid skimming flight; and, in those days, I have frequently seen them settling on the ground, and so filling themselves with insects—which were then plentiful—as to be able to rise only with difficulty. Matters nowadays have vastly changed, the wretched "pot-shotter" having killed off thousands of these and other useful birds of old colonial days.

The Nankeen Kestrel builds its nest of branches of trees, and this is lined with smaller twigs, grasses, etc.,

and is often built in a cliff or in the hollow spout of a tree, which latter position appears to be the one usually selected by the female bird.

Mr. A. J. North, the well-known Australian ornithologist, mentions a nest as being three and a-half feet high, by four or five broad, and about eighteen inches deep, the nest being built upon the fork of a tree fully seventy feet from the ground. The ground color of the eggs (usually four or five in number), is a dirty white or fawn, freckled all over with reddish-brown (see figure in our plate), the eggs being variable, both in size and in color.

With regard to the nesting, Mr. Campbell and others mention the case of these birds laying their eggs in the abandoned nests of the raven, crow-shrike, etc. The Kestrel well deserves its reputation as a destroyer of noxious insects, and it is to be hoped that it will be protected against all comers.



C. C. Brattlebank, Del.

C. French, Direct.

Osboldstone & Co. Print.

"THE MAGPIE LARK."
Grallina picata, (Latham).
Plate LXXXVIII.

CHAPTER XCV.

THE MAGPIE LARK

(*Grallina picata*, Latham.)

This bird, commonly known as the Mud-lark, Pewit, and *Pied Grallina*, is a general favorite with the rural public especially, it being a great destroyer of all kinds of insects. Its well-known note "pee-wee," is as well known in the vicinity of rivers, creeks, water-holes or swamps, as it is in the parched up plains of the lower Murray country, or in the back blocks of Queensland; and in trees overhanging the water it frequently builds its singular mud nests (see plate), and rears its young. It also builds in pines and other trees, in the Botanic Gardens and reserves of Melbourne; and, as the nest is usually placed on or near the end of a branch, it is thus, in most instances, out of reach of the average boy.

The nest is composed of small pieces of mud, sand, and clay, mixed with pieces of dry grass, etc., and generally measures about five or six inches in breadth, and from three to four in depth. The eggs, the usual clutch of which consist of four, vary greatly. The usual color is pinkish-white, with brownish spots, often forming a distinct zone at the larger end. In some instances the ground color is light reddish, with a zone of dark reddish spots, also in the larger end.

On the Murray River at Benjeroop, near Kerang, I have seen old nests of the Magpie Lark used by the White-rumped Wood-swallow (*Artamus leucopygialis*), and, according to Mr. A. J. Campbell, the little Cuckoo-shrike (*Graucalus mentalis*) also constructs its nest within the nest of the Magpie Lark.

The following is Gould's description of the Magpie Lark:—"The sexes are very similar in size, but the female may, at all times, be distinguished from the male

by her white forehead and throat, a fact which I have determined many times by actual dissection, thus showing the fallacy of the opinion, entertained by some naturalists, of their being two distinct species. The male has a line over the eye, a patch on each side of the neck, a longitudinal stripe on the wings, tips of the secondaries, rump, upper tail coverts, the basal two-thirds, and the tips of the tail, under surface of the shoulder, breast, flanks, abdomen, and under tail coverts, white; the remainder of the plumage, black, with a deep bluish tinge on the head, throat, chest, and back, and a green tinge on the primaries and tail; bill, yellowish-white; irides, straw-yellow; feet, black. The female differs in having the forehead lores and chin white. The young, on leaving the nest, have the irides black; in other respects they resemble their parents, but are, of course, far less brilliant in color."

Mr. A. J. North, of the Sydney Museum, records the following interesting particulars regarding this useful insect-destroying bird:—"Stomachs of these birds which I have examined contained chiefly portions of various insects, those shot near the coast also containing a little sand, mixed with a few blades of grass. I have never known it to eat either fruit or grain. Pastoralists, farmers, and orchardists, to whom this bird renders valuable services, should, therefore, assist in affording it absolute protection by preventing thoughtless boys and pot-hunters from trespassing on their lands in search for "something to kill," not only in the close season, but all the year round. The ever-trustful and fearless disposition of the bird should be, in itself, sufficient claim for its protection, which it undoubtedly deserves; but, unfortunately, the easy manner in which it may be approached is too often the cause of many of them falling victims to a misplaced confidence in man. It is an extremely sociable bird, frequenting the vicinity of houses, and breeding in trees close to the streets in many of the outlying suburbs."

With regard to the courage displayed by these plucky little birds, it may be mentioned that, as a rule, but very few other birds care to attack them; and the ever-pugnacious magpie (Crow-shrike) does not care to interfere with it, even although the Mud-lark is mostly the aggressor, it being quite a common sight to see these little birds chasing a magpie. In Queensland, however, I once saw the tables turned, and the magpie appeared as if determined to be revenged, it following the smaller bird for fully a quarter of an hour, but, I am glad to say, without success. The Mud-lark is afraid of very few birds; and, although it will chase the little Kestrel Hawk, I have seen them hide when a Sparrow-hawk was flitting about; but the Brown Hawk, and, in fact, several other kinds of hawks appear to have some terror of them.

Farmers and graziers especially are very fond of these birds, which may be seen flying about, and on the backs of cows and horses, especially the former. The Mud-lark is widely distributed throughout Victoria, and is found in South Australia, Queensland, New South Wales, and in Central, Western, and North-western Australia, as well as in Tasmania.



C. C. Brittlebank, Del.

C. French, Direxit.

Osboldstone & Co., Print.

"OWLET NIGHTJAR."

Ægotheles novæ-hollandiæ, (Latham.)

Plate LXXXIX.

CHAPTER XCVI.

OWLET NIGHTJAR.

(*Egotheles novæ-hollandiæ*, Vigors and Horsfield.)

The following description of this interesting bird is taken from Mr. R. Hall's useful book on the "*Insectivorous Birds of Victoria*," page 157:—"Mouth very much split; gape very wide; two stripes on brown head, and two crescents on hinder part, white; back, rump, upper wing coverts, and upper tail coverts, deeply vermiculated with pale grey; tail barred; wing quills grey, marbled and spotted; lower parts whitish, with dusky vermiculations. Total length, 8.5 inches. Some specimens show a rufous tinge over the body."

I well remember my first experience amongst these little Owlets. In company with the Messrs. Brittlebank, of Myrning, we visited the Werribee Gorge and came across several pairs of this peculiar bird. On tapping the trees with a tomahawk, the birds would fly out of the hollow limbs of the trees; and, on looking into the hollow from whence they came, one could see, a couple of feet down, the roundish white eggs (which usually measure, according to Mr. A. J. Campbell, 1.08 x .84). Mr. Campbell also states that these eggs, when rubbed together, produce a porcelain or china sound.

The nest, if it can be called one, is simply a few eucalyptus leaves placed in the bottom of the hollow bough or spout of the tree; and the clutch of eggs varies from three to four, occasionally five. It has been proved that at least two broods are reared by each pair of birds during the season. Breeding season commences in October and lasts till December.

This bird is a great destroyer of night-flying insects. It remains in the hollow spout of the tree during the day, and, when evening sets in, it leaves its hiding-place, and sallies forth in search of food; the Cut-Worm Moths, *Agrotis*, *Heliothis*, etc., and their larvæ, which do an immense amount of damage to crops, etc., are destroyed in great numbers by these useful birds. No doubt many Codlin Moths—which are dusk-flyers—are eaten by them; so every protection should be afforded this little Nightjar, which is found in Victoria, New South Wales, Queensland, Western Australia, South Australia and Tasmania.



C. C. Brittlebank, Del.

C. French, Direxit.

Osboldstone & Co., Print.

"WHITE-THROATED THICKHEAD."
Pachycephala gutturalis, (Latham).
Plate XC.

CHAPTER XCVII.

WHITE-THROATED THICKHEAD.

(*Pachycephala gutturalis*, Latham.)

According to Gould, the male has the crown of the head, lores, line beneath the eye, ear coverts, and a crescent-shaped mark from the latter across the breast, deep black; throat, within the black, white; back of the neck, a narrow line down each side of the chest behind the black crescent, and all the under surface, gamboge-yellow; back and upper tail coverts, yellowish-olive; wing coverts, blackish-brown, margined with yellowish-olive; primaries and secondaries, blackish-brown, margined with greyish-olive; basal half of the tail, grey; apical half, blackish-brown, tipped with grey; irides, dark brown; bill, black; legs and feet, blackish-grey.

The female has the whole of the upper surface and tail greyish-brown; primaries and secondaries, brown, margined with grey; throat, pale brown, freckled with white; remainder of the under surface, pale brown, passing into deep buff on the abdomen.

This bird is generally found amongst tea tree (*Leptospermum*) and other trees and bushes growing near creeks and rivers, and its melodious note is well known to persons visiting the bush. These birds are fairly common at Ringwood, Dandenong Ranges, Warrandyte, and other localities within easy reach of Melbourne. It is a lovely bird, the bright orange-colored breast and the white throat of the male making it one of the most conspicuous birds to be found in the bush. Its food consists of noxious insects of all kinds, and it should be protected by growers and others interested in the preservation of our insectivorous birds. The nest,

which is usually placed a few feet from the ground in a thick bush, is a cup-shaped one, and composed of dry rootlets, grasses, etc., and is lined with a soft fibrous material. The eggs are very variable, from a creamy white to brownish buff, with dark lilac-colored spots, the latter often appearing as if beneath the surface of the shell; some eggs have a distinct zone on the larger end. Three eggs usually constitute the clutch for a sitting. The breeding time is principally during October, November, and December. The hen bird will often remain on the nest till almost within reach of the hand; when, like a flash, it will fly off the nest if a person comes too near it, and will return again in a few moments to the nest when one is out of sight. Mr. A. J. Campbell gives the dimensions of the eggs as follows:—Dimensions, in inches, of a proper clutch: (1) .91 x .68, (2) .9 x .67, (3) .9 x .68. Mr. Campbell refers to this bird as follows:—"The beautiful White-throated Thickhead is a true scrub or forest-loving bird, its clear, sweet voice being oftener heard amongst the flowering eucalypts than the vocalist itself is seen."

Mr. Robert Hall says:—"A phase of this first plumage is the throat of the rusty-brown bird becoming greyish-white (February, 1897), while, from what I have seen in the field, another phase when handled would, I believe, show the throat to be rusty-brown—the second-last phase (wings last) to remain rusty-brown in the complete change from phase one to phase two. An example of the February phase, of bird above, was held under observation by Mr. Graham until 25th July, losing sight of it between the 18th and 25th July. This inclines me to believe that the rusty-brown or first plumage is retained for more than six months, and that it gives way to the grey, or second phase, in time for the first breeding season—a season of immature and very modest plumage. The want of competition, surely, is the male bird's champion! Phase three, of a male that must be at least two years of age, is an elegant one."



C. C. Brittlebank, Del.

C. F. French, Direct.

Osgoodstone & Co. Print.

FLAME-BREASTED ROBIN.

Petarca phoenicea

Plate XCI.

CHAPTER XCVIII.

THE FLAME-BREASTED ROBIN.

(*Petræca phœnicia*, Gould.)

This beautiful little Robin is one of our most valuable native insect-destroying birds, and which, at one time, was fairly common in the parks and gardens around Melbourne. Of late, however, it has become comparatively rare near the city, modern civilization being partly responsible for the "wiping out" of many of our natural beauty spots, and, with them, the final departure of many of our best and most beautiful birds. The extreme tameness of these birds (Robins) renders their being easily killed by those who are always ready to kill any living thing in the bird line, whether it be useful or otherwise—a class, unfortunately, all too common in our midst. As instancing how little fear of man they possess, I may mention that quite recently, while a cricket match was being played in one of our northern suburbs, a Robin alighted on the hat of one of the players, who was standing still, and remained there for several seconds until the fieldsman commenced to move.

The Flame-breast is well known to most of us, alighting on a rail or twig, and darting off again like a flash of scarlet color, only to alight again as quickly as it had left.

The male, according to Gould, has the crown of the head and all the upper surface sooty-grey, except a small white spot across the forehead; a patch of the same color on the shoulders and the anterior edges of the tertials; primaries and tail feathers, greyish-black, except the outer feathers of the latter, which are nearly

all white ; upper part of throat, sooty-grey ; the rest of the under surface, rich scarlet ; under tail coverts, white ; irides, bill, and feet, black.

The female is a uniform brown above ; wings, dark brown ; tertials and wing coverts, edged with reddish-grey ; tail, brown ; the outer tail feathers on each side, almost wholly white ; all the under surface, reddish-grey ; irides, feet, and bill, black.

The Flame-breasted Robin is very active on the wing, and may be seen darting at, and catching, moths and other insects. It is also particularly fond of aphids of various kinds, and may be observed hopping about rose bushes, abutilons, bouvardias, etc., devouring great numbers of these very destructive pests. Earth-worms, grubs of beetles, moths and butterflies constitute their principal food. These Robins—as we have before stated—are firm friends of the farmer and orchardist ; and, when the ground is being ploughed, they may be seen on the fences watching for any grubs which may be turned up, and frequently darting down to pick them up, and then returning to the fence—this going on for hours together. The nest is usually placed in the fork of an old dead or burnt tree, or on the sides of a steep bank, and is composed of strips and small pieces of bark matted together, and generally lined with hair, fine rootlets, fur, and occasionally feathers. The clutch of eggs is generally three ; but, as Mr. A. J. Campbell says, occasionally four. The breeding season is August, September, October, and November. Although protected, it is well known that numbers of these pretty and useful birds are destroyed wholesale, the “permit” to shoot birds and collect their eggs being often sadly abused.

Unfortunately for the male of this bird, as well as of many others, the colors are so rich and striking that they become an easy prey to the “destroyer ;” while, in many cases, the more sombre female gets off scot-free.

This species is found also in Southern Queensland, New South Wales, South Australia, Tasmania, and on other islands in Bass Straits.

Mr. R. Hall, in his valuable little work, "*Insectivorous Birds of Victoria*," says:—"Where they go in spring and summer has been as great a mystery as where the pelican lays its eggs; but now we know they keep on their bright colors, and simply retire to the forest to rest. The Flame-breast goes away earlier and deeper into the woods than the Scarlet-breast. While comparing this bird with the conspicuous Blue Wren, it is interesting to note that the male is always red; while the Wren moults its blue, and goes through the winter in a modest brown dress, and, with the spring, dons the blue again. It takes a Robin at least three years to secure a thoroughly brilliant red. To see thirty-five male Robins of one species close together in a field is a sight worth a deal of trouble to see. This occurs in July, before the breeding season in August and the following four months. Two or three broods are reared in a season. The male Flame-breast, *P. phœnicia*, is a little musical. It has a set bar containing some seven notes, very sweet, varying, and occupying about two and a-half seconds in production. The throat of the Flame-breasted Robin is red, while that of the Scarlet-breasted is black."



C. C. Brittlebank, Del.

C. French, Directr,

Osboldstone & Co., Print

"THE RED-CAPPED ROBIN."

Petroeca goodenovii, (Vigors and Horsfield).

Plate XCII.

CHAPTER IC.

THE RED-CAPPED ROBIN.

(*Petræca goodenovii*, Vigors and Horsfield.)

The subject of this chapter is one of the prettiest, as well as one of the rarest of the robins. Its home is mostly in the north-western parts of the State, and in the Swan Hill district it is not uncommon. I have seen it in the company of the pretty White-winged Wren (*Malurus leucopterus*), when they were hopping about together, and, on watching them from the shelter of a partly concealed mallee-branch, I saw that they were busily engaged in hunting for insects, at this time mostly small dipterous flies and other winged insects. The Red-capped Robin, as our plate shows, builds a very singular and pretty nest, which, Mr. R. Hall states, takes from twelve to fifteen days to build. The nest is generally built in the fork of a tree, and to the unpractised eye it is not easily found. Lichens are largely employed as the decorative articles of these nests, and, when carefully done, give the nest a very pretty appearance. The figures shown are about half the size of the birds themselves.

The eggs laid by this bird are two in number, and, according to Mr. Hall and others, three eggs sometimes form the clutch. A naturalist friend, Mr. J. A. Hill, of Kewell, Victoria, writes to Mr. Hall, saying—that in his district (Wimmera), these birds have two broods in a season, the first in August and the last in December. Very young birds are flying about in September, and birds are accompanying their parents in April (Swan Hill district). It was in November and December when I saw them, having been in the locality for some time, on locust extermination business.

It was noticed that both these birds and their tiny companions, the wrens, were somewhat shy, and even when not approached, seemed timid and anxious to get away into the more dense cover of the stunted mallee. Judging by the manner in which these birds were insect hunting, when I saw them, I should say that for their size they can have but few equals as insectivorous birds. The female, as will be seen from the plate, is of the same sombre colors as the females of the other robins, the male alone carrying the bright plumage, and also the greater risk of being killed for "scientific" or other purposes.

The mallee farmer knows the value of this useful little bird, and any person attempting their destructive work would, in all probability, have a bad time of it. It is found also in New South Wales, South Queensland, South Australia, and in West Australia.



C. C. Brittlebank, Del.

C. French, Direxit.

Osboldstone & Co., Print.

"HARMONIOUS SHRIKE THRUSH."
Collyriocincla harmonica, (Latham.)

Plate XCIII.

CHAPTER C.

THE HARMONIOUS, OR GREY SHRIKE, THRUSH.

(*Collyriocinclla harmonica*, Gould.)

This is a common and widely distributed species, and is a great destroyer of insects of various kinds, and should be protected by all orchardists and others interested in our fruit-growing industry, also by the general public. The well-known note of this bird is familiar to all lovers of the bush and its bird-life, and is always welcome. The Harmonious Thrush is found in many parts of Victoria, New South Wales, Queensland, and South Australia, its melodious note being frequently heard, especially in heavily timbered country near mountains, in country bordering on creeks, and also in the drier districts of the Mallee. This bird is of a most sociable disposition, and may be frequently seen in the gardens near to the Metropolis, when it becomes fairly tame.

The nest of this species, which is usually placed in the fork of a tree close to a creek, is round, the outside being formed of strips of bark (stringy bark for preference), and lined inside with rootlets, the average size of the nest measuring six inches externally, and five inches in depth. Nests are occasionally placed in hollow stumps of trees, between the forks of small trees, and sometimes among debris close to the ground. Mr. A. J. Campbell states that, not infrequently, this Shrike Thrush builds in the deserted nest of some other bird. Nidification usually takes place during August, September, October, and November.

Mr. A. J. North states that the eggs are deposited on successive days, and full sets of fresh eggs are not uncommon in the last week in August. Mr. North also

records the fact of a nest having been taken on 25th July, 1896, and a full set of fresh eggs on 7th August, 1897. Eggs of the Pallid Cuckoo (*Cucalus pallidus*) have been taken in the nests of this thrush. A favorite locality of these birds used to be on the shady banks of the Dandenong Creek, a few miles from Oakleigh, but, owing to much of the land in the locality having being cleared, the birds have mostly left for the ranges; but this is, in one respect, an advantage, as the nests will now be more difficult to find; and the ranges being out of reach of many "town" boys will, it is hoped, give the birds a chance to rear their young. As an example of the wholesale destruction of the eggs of this bird, it may be mentioned that one boy admitted having taken thirty-five eggs from nests built in the tea-tree (*Melaleuca*) scrubs, near Wheeler's Hill on the Fern-tree Gully Road. The number of eggs laid for a sitting is three, oval in form (see plate), sometimes elongated, and are of a buff-white ground color, with blotches of light brown, with light markings of grey appearing as if beneath the surface of the shell; and sometimes the brown markings form a distinct zone on the eggs.

Mr. A. J. North gives the following interesting particulars concerning this bird:—"Writing from Eden, Twofold Bay, in August, 1901, Mr. J. A. Boyd informs me that one of these birds sits and whistles on his back verandah, until he gives it some scraps of food from the safe, a bit of cheese being a great dainty. It is so tame that it will almost eat out of the hand."

The following description is taken from "*Gould's Handbook to the Birds of Australia*":—"The term *harmonica* as applied to this species is most appropriate; for, although it does not give utterance to any continual song, it frequently pours forth a number of powerful swelling notes, louder, but less varied, than those of the Song Thrush of Europe; and it is somewhat singular that these notes are emitted while the bird is in the act of feeding, and while in search of its insect food. The

sexes are very nearly alike, the principal difference being that the female has the bill browner and an indication of a white stripe over the eye."

It is most gratifying to know that, of late years, our State-school teachers and others have tried, so far as lies in their power, to discourage the habit of egg collecting among their scholars, also to omit all awards of egg exhibits from their prize lists. It is sincerely to be hoped that private schools will follow their example.



C. C. Brittlebank, Del.

C. French, Direxit.

Osboldstone & Co., Print.

"WELCOME SWALLOW."
Hirundo neoxena, (Gould).

Plate XCIV.

CHAPTER CI.

THE WELCOME SWALLOW.

(Hirundo neoxena, Gould.)

The following description of this bird is given by Gould:—

“Forehead, chin, throat, and chest, rust-red; head, back of neck, back scapularies, wing coverts, rump, and upper tail coverts, deep steel-blue; wings and tail, blackish brown, all but the two centre feathers of the latter with an oblique mark of white on the inner web; under surface, very pale brown; under tail coverts, pale brown, passing into an irregular crescent-shaped mark near the extremity, and tipped with white; irides, dark brown; bill and legs, black.”

This homely little insectivorous and migratory bird is respected by all—even the small boys, who rob all other birds' nests, when they discover a swallow's nest, rarely interfere with it, though often within easy reach. In Camberwell, this season, there were no less than four swallows' nests in the main street, built under verandahs a few feet from the ground, and were passed by hundreds of children, who watched the old birds feeding the young when the latter were reared. This is, no doubt, the outcome of nature study in the schools, the children being taught by their teachers to protect insectivorous and other useful birds, some excellent articles having been written in the school papers concerning this and other useful birds.

The well-known mud nests of these birds need hardly any description, as they are so familiar, often being built in the heart of this city. One nest was observed recently within a stone's throw of the General Post Office. The nest is composed of small pellets of mud,

lined with feathers, grasses, etc., and resembles, as Mr. Campbell says, a bisected bowl, cemented to the side of a wall of rock, cave or cliff, under verandah, on posts, etc. Many curious nesting places have been recorded; and it may not be out of place to quote Dr. Ramsay, who says:—"In 1858, while fishing off a small steamer, which, having been out of use for some months, was moored a hundred yards from the North Shore of Sydney Harbour, I observed a pair of these swallows fly round the boat, and frequently dive underneath the paddle-box. After a long search I discovered their nest, which was composed of thick pitchy mud, lined with seaweed and feathers. It was placed upon one of the horizontal beams of the paddle-box, and contained three young ones about half-fledged. The man in charge informed me that the nest had been made when the steamer was lying lower down the Harbour, and, upon its being tugged to where it then lay, the birds flew round and round it the whole time, evidently in a state of great excitement."

The eggs of the Welcome Swallow are oval in shape; color, whitish, speckled all over with numerous reddish-brown markings, often forming a distinct zone on the larger end. Three to five usually constitute a clutch. Breeding months are from September to December. Mr. G. Graham states that the operation of building the nest was commenced on the 7th of September, and by the 19th inst. the earthen cup was finished; by the 30th inst. the lining was fixed, and an egg was laid.



W. Woodcock Del.

C. French Direct.

Osboldstone & Co., Print.

"YELLOW-RUMPED TOM TIT."

Acanthiza chrysorrhea, (Quoy et Gaim).

Plate XCV.

CHAPTER CII.

THE YELLOW-RUMPED TOMTIT.

(*Acanthiza chrysorrhæa*, *Quoy et Gaim.*)

This pretty little bird, so well known to almost every grower, orchardist, and farmer, is one of the most valuable of our insect-destroying birds, killing out—as it does—vast numbers of insect pests; it is found in nearly every portion of Victoria. The Tomtit is a very sociable bird, frequenting public parks and gardens near to the city, building its nests and rearing its young in the prickly *Acacia* hedges (*A. armata*); also in Pine, *Araucaria*, *Leptospermum*, and other plants. The nest is suspended, dome-shaped, with a small side entrance, outwardly composed of pieces of grass, cocoons of the spider (*Voconia*)—and erroneously called by the colonists *Tarantula*—and other spiders, pieces of rag, twigs of various plants, rootlets, etc., and lined inside with feathers, cotton-wool, and, in some instances, with rabbit fur and other soft substances. Many of these nests have a kind of dome-shaped opening on the top, in which the male bird is supposed to sleep while the female is sitting on the eggs. The small Cuckoo and the Bronze often deposit their eggs in the Yellow-rump's nest. The Yellow-rump is an early breeder, nests and eggs having been observed by Mr. C. French, Jr., as early as May, in the Fawkner and other parks near the city. Nests are also found attached underneath nests of the White-backed Crow-shrike (Magpie).

On the Werribee plains in the she-oak trees (*Casuarina*) are many Crows' nests, and occasionally placed under these large stick-nests are nests of the Yellow-rumps; also nests of another valuable insectivorous bird, the White-faced Xerophila.

The eggs of the Yellow-tail are mostly pure white, but occasionally have a few light-reddish spots, in some instances almost forming a zone not unlike the eggs of the Blue Wren or Superb Warbler. Eggs, usually three or four for a sitting.

Gould, in his work on the "*Birds of Australia*," says "that the sexes are alike in plumage, and may be thus described: Forehead, black, with a spot of white at the tip of each feather; cheek, throat, and a line from the nostrils over each eye, greyish-white; chest and under surface yellowish-white, passing into light olive-brown on the flanks; upper surface and wings, olive brown; rump and upper tail coverts, light citron-yellow; base of the tail feather, white, tinged with yellow; the external margin of the outer feathers and the tips of all, brownish-grey; the central portion, blackish-brown; bill and feet, blackish-brown; irides, very light grey."

Found also in Queensland, New South Wales, South and Western Australia, and in Tasmania.



C. C. Brittlebank, Del.

C. French, Drexil.

Osboldstone & Co., Print.

"AUSTRALIAN BEE EATER."

Merops ornatus, (Latham).

Plate XCVI.

CHAPTER CIII.

THE AUSTRALIAN BEE-EATER.

(Merops ornatus, Latham.)

A remarkably handsome bird unlike, especially in color, any other of our Australian birds. The general plumage of this bird is a beautiful golden green and azure blue, the feathers of the throat being a deep yellow. Length of bird, according to Mr. Campbell, ten inches, including the tail (six inches) and bill (one and a half inches). The tail feathers, as shown on the plate, are of a peculiar shape and color.

The habits of this bird are partially migratory, birds being fairly plentiful in some of the north and north-eastern parts of the State. They appear in September, and, according to Mr. Campbell and other ornithologists, leave again in March. The eggs, usually five in number, are deposited in holes made in the sandy banks of rivers, the young birds being fairly strong about the middle of January. This bird seems to like the heat, as, on the hottest days (112 degrees in the shade) I have seen them in numbers, when driving from Rutherglen to Chiltern, in the north-eastern part of Victoria. When I saw them they were very active, and busily engaged in catching insects when on the wing. The Bee-eater has a bad reputation among apiarists in Victoria, as being a great destroyer of bees; but the strictly insectivorous nature of the bird, renders it much more valuable than many people imagine.

I have seen the holes, in which the young are reared, strewn with the remains of bee-moths, plant-bugs, moths, etc., and here and there the remains of an odd bee; still it may be that the parent birds dissect the bees

before feeding their young with them. This bird, when on the wing, has somewhat the flight of our lovely and well-known little Wood-swallows (*Artamus*), the summer-birds of the old colonists; the poise being easy, showing the lovely yellow throat, blue cheek markings, and elegantly tapered bill.

This species is also found in New South Wales, Queensland, West Australia, and in New Guinea. Mr. A. R. Wallace, the celebrated traveller, also mentions finding it on the island of Lombock, in the Malayan Archipelago. Mr. Campbell also states that snakes are frequently found in the holes made by these birds; so the indiscriminate egg-hunting fiend had better beware.



C. C. Brittlebank, Del.

C. French, Direxit.

Osboldstone & Co., Print.

"BLUE WREN," or "SUPERB WARBLER."

Malurus cyaneus, (Ellis).

Plate XCVII.

CHAPTER CIV.

THE BLUE WREN OR SUPERB WARBLER.

(Malurus cyaneus, Ellis.)

This useful little gem is so well known as to hardly need any description, it being a general favorite everywhere.

The plumage of the male of the Blue Wren—as the plate shows—is much more showy than that of the female, the lovely blue feathers forming a striking contrast with the more sombre plumage of its tiny mate.

The nest, to quote Mr. Campbell, is globular, side-top entrance, usually composed of old, greyish, weather-beaten grass, with an admixture of cocoons, lined inside with fine yellow-colored grass; and, finally, with feathers, hair, down, seed-vessels, etc., placed near the ground in a low dense bush or tussock of grass. The eggs are laid in clutches of from three to four, occasionally five; the shape, size and color being according to the accompanying plate. The breeding season is included in the months from August and September to January, during which period it rears two or three broods. It is also well known to ornithologists in Victoria and elsewhere as being among the foster-parents of the Narrow-billed Bronze Cuckoo—itself a valuable insect-destroyer, and about which we have already written in Part III. of the present work. This beautiful species varies considerably in its markings, but this fact can only be observed by anyone skilled in bush matters, Mr. R. Hall, formerly of our city, having given this part of the subject much consideration. The male of this species is polygamous, it being no uncommon sight to witness

the funny little fellow strutting about in the company of several tiny females. The Blue Wren is strictly insectivorous; and, although so small, destroys vast numbers of insects.

In Mr. R. Hall's work on the "*Insectivorous Birds of Victoria*"—showing the valuable nature of this bird as an insect-destroyer—he quotes from some experiments made by a friend of his, Mr. Geo. Graham. Mr. Hall says:—"The persistent work of my correspondent—Mr. George Graham—as a skilled keeper of Wrens in captivity, in the providing of food, proves that a pair are capable of eating eighty larvæ of one of the so-called Cockchafer Beetles daily for months in succession. As to the food supplied—quantity, preference, etc.—it was noted that, from July to the 1st of January, grubs with a little finely-chopped meat, bread crumbs, small beetles, and caterpillars, formed the bulk of the food. It generally managed to dispose of sixty grubs, about a dozen small insects, and a small proportion of bread and meat sufficient to equal the bulk of 100 grubs—as named above—per day. From the 1st of January to the 1st of April grasshoppers formed the staple, varied with March flies and cockroaches. The quantity devoured amounts to about the same as the grubs, namely, 100 per day; and the immature form of the great green grasshopper is preferred to all other kinds of food given to it. Moths, March flies, and small winged insects, are greedily devoured; in fact, it can stow away four large 'blow-flies' on a fairly full stomach."

There are, happily, but few people who would kill one of these useful and pretty warblers, which, to prevent their entire destruction, should be protected against all comers, no matter who or what they are.

These birds are found also in New South Wales and Queensland.

For more lengthy particulars, consult the works of Messrs. A. J. Campbell, North, R. Hall, and others.

It may be mentioned that these birds may be seen fairly common, especially after a shower of rain, when the little fellows may be seen enjoying the bright sunshine, with its consequent drying of plumage.

The genus *Malurus* is an Australian one, sixteen species being found in Australia, seven of which hail also from Victoria, the white-backed species being somewhat common in the hotter and north-western portions of the State.



C. C. Brittlebank, Del.

C. French, Directr.

Osboldstone & Co., Print.

"WHITE-BROWED BABBLER," or "CODLIN MOTH BIRD."

Pomatostomus superciliosus, (Vigors and Horsfield).

Plate XCVIII.

CHAPTER CV.

WHITE-BROWED BABBLER, OR CODLIN MOTH BIRD.

(*Pomatostomus superciliosus*, Vigors and Horsfield.)

Regarding this bird, Gould says the sexes, as well as the young, so closely resemble each other, that they can only be distinguished by the aid of dissection.

Lores, space surrounding the eye and ear coverts, dark silky-brown; a broad line of white, bounded above and beneath with a narrow one of dark brown, commences at the base of the upper mandible, passes over the eye, and continues to the occiput; crown of the head and all the upper surface, flanks, and under tail coverts, olive-brown, passing into a purer and deeper brown on the primaries; tail, dark brown, crossed by very indistinct bars of a darker color, the five lateral feathers on each side tipped with white; chin, throat, and chest, white; bill, blackish-brown; the lower part of the under mandible, greyish-white; irides in the adult, straw-yellow; in the young, brown; feet, blackish-brown.

The habits of this well-known insectivorous bird are similar to those of the Temporal *Pomatostomus*, which is regarded by orchardists as the best Codlin grub-destroying bird that visits the orchards. The White-browed *Pomatostomus* is exceptionally plentiful towards the Murray, also in the Mallee, and occasionally near Melbourne. The nest is a bulky structure, with a side entrance, composed of sticks and strong rootlets, and lined with bark, grass, etc. The eggs are light grey, marked all over with dark hair-like markings, often forming a slight zone on the larger end. Clutch usually from three to five; and, according to Mr. A. J. Campbell, eggs measure (1) .99 x .66, (2) .95 x .67. Breeding months—October, November, and December.

Mr. Campbell says:—"This smaller-sized Babbler has a wider distribution than the common variety, being found in both Eastern and Western Australia. Like its larger cousin, it may be seen, even in the same locality—seven or eight in a flock hopping over the ground like rats—pulling away at the short grass, or levering over lumps of bark or sticks with its beak or head. When disturbed, with spread tail and wings, these birds leap actively from branch to branch through the trees, uttering chattering noises, but not quite so loudly as the Temporal or Common Babbler. Like the Temporal Babbler, the White-browed uses one of its nests as a sleeping-place. At midwinter I have witnessed a troupe filing into their dormitory at dusk."

When on a collecting trip to the Murray many nests of this bird were noticed, as they were placed on the *Muehlenbeckia cunninghami* bushes a few feet from the ground.

APPENDIX.

MATERIALS IN USE FOR THE DESTRUCTION OF
NOXIOUS INSECTS.

1. ARSENATE OF LEAD.—Formula: Boil 1 lb. white arsenic and 2 lbs. carbonate of soda (crystals) in $\frac{1}{2}$ -gallon of water for 20 minutes. Separately dissolve 7 lbs. acetate of lead in 1 gallon warm water. When both mixtures are cold, mix them together. Bottle into 12 pint bottles, and use 1 bottle to 30 gallons of water. This is the best formula for dealing with codlin moth; and, when used consistently, will yield over 90 per cent. clean fruit. It may also be used with good success against leaf-eating insects, such as the vine-moth caterpillar, pear slug, cup moth, pumpkin beetle, etc. The preparation known as Swift's Arsenate of Lead has recently come largely into use in this and other Australian States; we have used it very successfully. It is easy to mix, and, if it can be placed cheaply on the market, will no doubt command a ready sale. At the present time the price of this preparation is much too high; and if it is to supersede the ordinary arsenate of lead now in use, it will have to be placed on the market at a much lower rate than it is at present. The Department is now arranging some further experiments to test the economic value of this and other preparations, the results of which tests will be made known through the columns of the "*Victorian Journal of Agriculture*."

2. WHITE ARSENIC.—This is, perhaps, the most effective agent of destruction against insects. It should always be used in conjunction with other chemicals. If placed in contact with any portion of a plant, some other chemical must be used in union with it, so that the caustic properties of the arsenic may be counteracted. For this purpose milk of lime or acetate of lead is generally used. A mixture of arsenic and sugar (or molasses) has proved very destructive to ants in houses. Arsenic mixed with bran and treacle, mixed together into a paste, is a very destructive agent for any such pests as army worms, locusts, etc., the mixture being placed in small bails wherever these insects are plentiful.

3. RED OIL.—Dissolve 1 lb. soft soap in 1 gallon of water by boiling. Then stir in 1 gallon of red oil, and allow the mixture to come to the boil again, stirring vigorously the whole time. Take this off the fire, and agitate briskly for 5 minutes, so as to thoroughly emulsify the materials. (In mixing these emulsions, it is always safer if the process be carried on in a building detached from the house.) For spraying, add 29 gallons of water, thus making the mixture 1 gallon of red oil to 30 of water. This spray should not be used on trees when the foliage is present, as it may burn the leaves. This formula has been successfully used by Mr. Pescott and other of the field inspectors against woolly aphis, mussel scale, San Jose scale, etc.: and Mr. Pescott states that one spraying has been found to eradicate the once-dreaded San Jose scale.

4. CRUDE PETROLEUM.—For spraying scale insects on foliage trees, or for spraying trees in leaf. This may be used in place of red oil. The method of emulsifying is the same, but the petroleum can be used much stronger than the red oil. It may be mentioned that all these emulsions work better if applied fairly hot.

5. TOBACCO.—Tobacco steeped in sufficient cold water to cover it, and well macerated to extract the nicotine, is used as an excellent remedy for black and green peach aphis. It should be used at the rate of 1 lb. to 4 or 5 gallons of water. Trees known to be affected with either green or black peach aphis have been successfully treated by placing 1 lb. tobacco, broken up, a few inches underground around the stem of the tree. This treatment should be carried out early in June, so as to allow the rains to soak through the tobacco and saturate the surrounding soil.

5. NICOTINE.—In nicotine, if the best brands only are used, we have an easy and effective way of dealing with insect blights of many kinds. For small gardens and glass houses especially, tobacco in this highly concentrated form is most useful, easily prepared and more effective than are many of the so-called remedies which are being constantly placed on our markets.

6. CARBON BI-SULPHIDE.—A very valuable aid to the fruit-grower, miller and others. For root borer, make (with an injector) 4 holes 15 inches deep, 4 feet from the tree attacked, and into each of these holes inject from 4 to 6 drachms of carbon, closing up the holes immediately. If properly done and the soil be not too stiff, *i.e.*, clay or cement, the fumes will penetrate through the subsoil and kill all grubs, and otherwise relieve the affected tree. This should be done twice each year. Inspector Pillond reports that at White Hills, Bendigo, and at Amphitheatre, this plan has been adopted with great success; in one garden at Amphitheatre, which was very bad with borer four years ago, owing to the carbon treatment being

persisted in no trace of the living borer can now be found. In treating weevil-infected grains, etc., furniture, furs, hides, etc., attacked by insects of many kinds, the carbon bi-sulphide will be found invaluable. It may be hardly necessary to explain that carbon bi-sulphide, being explosive, should be used away from close proximity to any artificial light, such as candles, lamps, etc., and should be used in an outhouse or in some building detached from the dwelling-house.

7. OIL OF TAR EMULSION.—A valuable material for spraying against leaf-feeding insects, and has been successfully used by Inspectors Farrell and Wallis against the pumpkin beetle, etc. Formula: Crude oil of tar, 1 pint; soft soap, 1 lb.; caustic soda, 1 oz.; water, 10 gallons. Boil one pint of water, and in it dissolve the soap and soda; add the oil of tar and agitate well with a garden syringe till thoroughly emulsified. Then add the remainder of the water (hot), mix well, and use as hot as possible.

8. SULPHIDE OF LIME.—Inspector Davey reports having used this material very successfully against red spider and acarids (mites) generally. Formula: Boil together 1 lb. flour of sulphur and 1 lb. of lump lime in 2 gallons of water until dissolved; then add 18 gallons of water. This material should be useful against thrips and insects of this class.

9. MURIATE OR CHLORIDE OF POTASH.—This material has been proved by us to be, so far, the most effective agent in destroying peach aphid of both kinds at the roots. Trees badly affected with green aphid for some years have been completely cleaned by placing from 1 to $1\frac{1}{2}$ lbs. around the stem of the tree early in June. The potash should be dug into the soil, a few inches below the surface.

10. GYPSUM.—This material—being cheap—has been used very successfully against pasture grubs and similar underground pests. Use at the rate of from 5 to 6 cwt. per acre. We have had good results from the use of the so-called colonial gypsum. Inspector Pescott is of the opinion that gypsum has proved only fairly successful in heavy clay soils, where, by chemical action, it has released the potash in the soil. Gypsum has been used successfully by Inspector Meeking against the dark-green pasture grub.

There are many other materials on the market which are highly recommended as being of value in spraying; but many of them have not the merit of cheapness combined with effectiveness—two conditions which must be insisted upon if spraying is to be as popular and remunerative as it deserves to be.

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